THE

FOUNDRY TRADE JOURNAL

WITH WHICH IS INCORPORATED

THE IRON AND STEEL TRADES JOURNAL

VOL. 48. Thursday, May 18, 1933. No. 874.

PUBLISHED WEEKLY.

Subscription Terms: 15s. per annum.
Foreign and Colonial: 17s. 6d. per annum.
All Subscriptions are payable in advance.

All Communications to be addressed to the Editor, the Advertisement Manager, or the Publisher of

THE FOUNDRY TRADE JOURNAL,
49, WELLINGTON STREET, LONDON, W.C.2.

Telegraphic Address: "Zacatecas, Rand, London."
Telephone: Temple Bar 3951 (5 lines).

Contents.

	PAGE
Forthcoming Events	345
Methods of Analysis	345
The Cardiff Conference	345
Correspondence	346
New Members of the B.C.I.R.A.	346
Random Shots	346
The Manufacture and Physical Properties of Nickel-Copper-Chromium Austenitic Cast Irons	347
The Technical Committee and Technical Developments in Connection with the Institute	349
The Open-Hearth Process for Steel Castings Production	351
I.B.F.: Scottish Branch	353
Refractories	354
American Foundrymen's Association	355
Tin Uncertainties	355
This Week's News in Brief	356
Trade Talk	356
Contracts Open	356
Company Reports	356
Personal	356
Obituary	356
Raw Material Markets	358

THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

Institute of British Foundrymen.

PRESIDENT: 1932-33:
Victor Stobie, M.I.E.E., Langholm, South Drive, Harrogate.

LIST OF SECRETARIES—
General Secretary: T. Makemson, Saint John Street Chambers, Deansgate, Manchester. London Office: 49, Wellington Street, London, W.C.2.
Birmingham, Coventry and West Midlands: L. W. Bolton, 21-23, St. Paul's Square, Birmingham.
Sheffield: T. R. Walker, 33, Ladysmith Avenue, Nether Edge, Sheffield.
Scottish: J. Bell, 60, St. Enoch Square, Glasgow.
Lancashire: J. E. Cooke, 1, Derbyshire Crescent, Stretford, Manchester.
London: H. W. Lockwood, Stewarts & Lloyds, Limited, Winchester House, Old Broad Street, London, E.C.2.
Newcastle-upon-Tyne: J. W. Eckford, 4, Mosley Street, Newcastle-upon-Tyne.
East Midlands: H. Bunting, 82, Otter Street, Derby.
West Riding of Yorkshire: S. W. Wise, 110, Pullan Avenue, Eccleshill, Bradford.
Wales and Monmouth: J. J. McClelland, 12, Clifton Place, Stow Hill, Newport, Mon.
Middlesbrough: F. A. Harper, Station Chambers, Middlesbrough.

Foundry Trades' Equipment and Supplies Association.

President: D. H. Wood,
Titan Works, Charles Henry Street, Birmingham.
Secretary: K. W. Bridges, Grand Buildings, Trafalgar Square, London, W.C.2.

Welsh Engineers' and Founders' Association.

Secretary: E. J. Griffiths, 2, Royal Metal Exchange, Swansea.

BRITISH CAST IRON RESEARCH ASSOCIATION
The Registered Office and Laboratories of the B.C.I.R.A. at:—
21-23, ST. PAUL'S SQUARE, BIRMINGHAM.
Telephone: Central 1895. Telegrams: CIRA.
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 332*).

Forthcoming Events.

Institute of British Foundrymen.

JUNE 20-23.

Institute of British Foundrymen:—Annual conference in Cardiff.

Methods of Analysis.

We reviewed recently in our columns a report issued to the members of the Cast Iron Research Association, and subsequently, in the interests of standardisation, to the industry as a whole, on recommended methods of analysis and sampling of cast ferrous metals and alloys. The original report was reviewed in 1929, and the new report is a second edition.

We have noted with particular interest the very considerable amount of new matter which has been incorporated. As the report explains, it is now by no means uncommon to find in cast iron such elements as nickel, chromium, molybdenum and, in certain cases, aluminium, vanadium, titanium and others. The problem which faces the chemist in these alloys is a difficult one, and the present publication gives recommended methods for the analysis of cast iron in respect of any element it is likely to contain. In addition, it illustrates the method of treatment for special cases where it may be desirable to determine the iron content directly instead of by difference.

Another useful addition is a statement of the methods used in the preparation of specimens for micro examination. Students of photomicrographs are well aware of the extraordinary variation in excellence of prints prepared from micro specimens, and the methods of preparation are by no means well understood. Here, again, cast iron presents peculiar difficulties on account of the graphite contents, for it is quite easy under some polishing conditions to open up the cavities until they look larger than they should, or, alternatively, to burr them over until they look smaller. Recommended magnifications are also given.

The amount of new matter is such that methods relating to the estimation of coke, coal dust and foundry blackings, and certain other materials, have been transferred to a similar publication, now in preparation, dealing with methods of testing moulding sands.

A particularly noticeable feature evident is that the methods have obviously been prepared for the use of chemists, and not for the use of those excellent chemical artisans who efficiently carry out chemical tests without proper training. This ensures an altogether admirable brevity and facilitates the explanation of the methods by giving the chemical equations on which the reactions depend.

The Cardiff Conference.

In a few weeks' time—June 20 to June 23—foundry executives from all over the country will once again be assembling to discuss the technical problems of their complex industry. It will be noted from a perusal of the programme, the details of which we published last week, and previously, that much time is to be devoted to the study of alloyed cast iron. This represents an ever-expanding field, but to the foundry executive there is a still greater importance, and that is, if a proper appreciation is obtained of the functioning of alloys and of the difficulties of manufacture, then the making of high-grade castings without the use of alloy additions becomes easier through this understanding. The more we learn of these new alloy irons, the more we are convinced that the best has yet to be obtained from the scientific blending of the more common and cheaper elements—carbon, silicon, manganese and copper. These considerations will be uppermost in the minds of those visiting Cardiff.

On the non-ferrous side, a Paper deals with the provision of coloured castings by the foundry industry. This development is still in its infancy, but we can see in it an effective reply to the competition which has recently been met from plastics, for small domestic articles, such as lamp holders, ash trays, novelties, telephone instruments and stoppers.

Another subject being dealt with is the mechanisation of foundries. The position has now arrived when the "snags" encountered are becoming known and appreciated. The boundary lines of economic utility are being established; the questions of steam and dust evacuation at the knock-out, the quantity of system sand necessary for a given output, the types of conveyor to be used in relation to each duty, are now more or less resolved. At least, the relative advantages of each type are known and can be enunciated. From the above it is abundantly clear that the matters to be discussed are the very ones about which the foundry industry is seeking information, and, social aspects apart, are amply sufficient to make the journey to Cardiff well worth while.

XUM

Correspondence.

[We accept no responsibility for the statements made or the opinions expressed by our correspondents.]

The Sand Question in Regard to Light-Casting Production.

To the Editor of The Foundry Trade Journal.

Sir,—I note with interest the criticism put forward by Mr. A. E. Burton in regard to my Paper on "The Sand Question in Regard to Light-Casting Production," relative to the loss in strength of baked cores before and after placing in green-sand moulds. In the first place, Table No. 3 is extracted from a Paper by H. L. Campbell on "The Effects of Moisture Absorption on the Properties of Dry-Sand Cores," Trans. American Foundrymen's Association, Vol. 35, 1927, page 158. The plan of this investigation was:—(1) To prepare test-cores from definite core-sand mixtures, (2) to bake these cores under specified conditions, (3) to place the baked cores in green-sand moulds for definite periods of time, and (4) to measure the properties of the cores before and after remaining in the moulds for definite lengths of time. Full particulars are given in this Paper of those points raised by Mr. Burton.

In giving reference to this work in my own Paper, it should be definitely understood that Table No. 3 must be studied in conjunction with my general remarks on correct baking schedules, which Mr. Burton has more definitely re-stated. I do not think, however, that the results taken are likely to give practical foundrymen a wrong impression if they are associated with my remarks. In general ironfoundry practice, even with good stoves and intelligent control, one cannot obtain the best drying schedule for each core, as these are of varying sizes, and no two stoves dry in a similar manner. Accordingly, I have the impression that any definite statement of baking time or period must of necessity be resolved into certain limits by the practical worker to meet individual practice, and I hesitate to suggest the best baking temperatures, etc., in view of the general nature of the Paper being given. In regard to the suggestion about showing the loss in transverse strength as a percentage, I consider this figure, given by itself, is absolutely valueless. A core may have a low-percentage loss and be totally unsuited to safe-casting production as its strength may be initially weak. Furthermore, in regard to the moisture content of the sand used for making the green-sand mould, carefully-conducted tests have shown that this can vary between 5.0 to 11.0 per cent. without causing any difference to the question of moisture absorption, and does not control the change in strength of the cores when placed in the mould.—Yours, etc.,

F. Hudson,
Chief Metallurgist.

Glenfield & Kennedy, Limited,
Kilmarnock.
May 12, 1933.

To the Editor of The Foundry Trade Journal.

Sir,—As Chairman of the Sands and Refractories Sub-Committee of the British Cast Iron Research Association, I should like to correct in one particular the Paper by Mr. F. Hudson published in your issues of April 13 and 20. He says that past work done by British investigators has been individual, that much more rapid progress would have been made had sand testing been co-ordinated through standardised-testing methods. Mr. Hudson cannot in this connection be ignorant of the work of the British Cast Iron Research Association, since he quotes an appeal for international standardisation made by Dr. Skerl in discussing a sand-testing Paper in 1929.

If the records of published work on natural moulding sands by those connected with the founding industry in this country are consulted, say, up to 1927, when the first draft of the B.C.I.R.A. tests was issued, it will be found that the list contains the names of Shaw, Boswell, Holmes, Watson, Dews, Fletcher, Smalley, Currie, Rhydderch and Rees. With the exception of Smalley, who went to the United States before the formation of the B.C.I.R.A. Sub-Committee, and Currie, the whole of these gentlemen are, or have been, connected, mostly directly, with the Sands and Refractories Sub-Committee of the British Cast Iron Research Association. The work of this Sub-Committee has been, and is, essentially co-operative, aiming at more rapid progress through the co-ordination and standardisation of testing methods.

The valuable Paper of Grundy and Philips in 1926, on foundry refractories, dealt in part with moulding sands, and on core sands there have been important contributions by Campion and McEachen, and West, but I am at present referring to testing natural moulding sands.—Yours, etc.,

E. Wharton.

Staveley.
May 14, 1933.

New Members of the B.C.I.R.A.

In the quarterly Bulletin of the British Cast Iron Research Association appears the following list of new members:—*Ordinary Members.*—Burn & Company, Limited, Howrah, Bengal (*Representative*, W. Gow); Crane Foundry Company, Limited, Wolverhampton (*Representative*, James A. Richards); Eclipse Tube Mill Liners (Pty.), Limited, Benoni, Transvaal, S. Africa (*Representative*, P. L. Ward); Joseph Henry, Limited, Leeds (*Representative*, W. H. Hartley); Henry Hollingdrake & Son, Limited, Stockport (*Representative*, Thomas Lee); Mason & Porter, Limited, Auckland, New Zealand (*Representative*, R. C. Porter). *Trade Members.*—Engineers Agents, Limited, London (*Representative*, Sydney Evans); Quiksol Products, Limited, London (*Representative*, E. E. Watson); Stein & Atkinson, Limited, London (*Representative*, J. S. Atkinson). *Associate Member.*—Bernard Collitt, Montreal, Canada.

Random Shots.

(*Concluded from next column.*)

and this would rule out all superfluous expenditures for the dead.

(9) *The Prohibition of Public Musical Performance and Amusement of any Form.*—Aside from sacrificial and educational purposes, theatricals and musical performances for amusement would be banned in times of depression, much in the same way as it would be in mourning.

(10) *The Encouragement of Simple and Easy Marriage.*—As marriage in old China was expensive and difficult, this would be a great relief for poor people in hard times.

(11) *The Holding of Prayer Services.*—When the Emperor led the officials and the people to pray to heaven and to the national patron gods for the speedy return of prosperity, it would certainly have a psychological effect on the populace.

(12) *A Check on Thieving and Banditry.*—Since depressions always brew more unrest and uprisings, an effective check of these from the very beginning would save the country from revolutions and wars.

These twelve items form the important measures of the Huang Cheng since the time of ancient China.

Marksman.

Random Shots.

I thought the following account of the economic control of depressions in Ancient China, sent me by a correspondent, sufficiently amusing to give in full in this column, although it is really only superficially funny. The average European regards the customs and speech of Ancient China as merely amusing and childlike, but the Chinese civilisation achieved much and was in some ways greater than our own. Our politicians could learn much from the following account; I would particularly recommend clause 2 to their attention.

* * *

Depressions, B.C.

Depressions are nothing new in history; they have been recorded periodically in the official history of China. The nearest Chinese word for depression is *Huang*, which means desolation. A depression of want is called *Chi Huang*, while a depression of fear is *K'ung Huang*. There is a classical term "Huang Cheng," which means political measures to deal with desolations. The oldest record of these measures can be found in the Chow Li, or the Book of Governmental Rites of the Chow dynasty. The Chow Li is one of the thirteen Confucian classics, the authorship of which is generally attributed to the Duke of Chow of the twelfth century, B.C. The following translation from the Chow Li was made by Dr. Kiang Kang-hu of the Gest Chinese Library of McGill University. The twelve items themselves are given in capitals. Commentary upon the meaning of these statements has grown through the centuries, but the explanation here summarised, after each item, is supposed to have been written in the first century, A.D. It should be re-emphasised that no part of the comment is made by me or by the translator.

(1) *The Distribution of Surplus Treasures.*—The government will provide not only funds for the relief work, but will also open up all storages of accumulated grains and other necessities of life for direct distribution.

(2) *The Lowering of Taxation.*—This will relieve people from public burdens and thus enable them to be self-supporting. The average land tax was less than 10 per cent. of its productive value and there were very few other taxes. During the time of depression the land tax was usually halved, or from the famine-stricken regions totally exempted.

(3) *The Mitigation of the Severity of Criminal Punishment.*—This is because people are more easily driven to crime when in distress, and therefore they deserve special mercy.

(4) *The Withholding of Labour Conscription.*—In the ancient times all male citizens, excepting officials and scholars, were subject to government conscription for public works between the planting and the harvesting seasons. This conscription would be withheld in times of depression, so that the people might work more profitably.

(5) *The Lifting of Legal Prohibitions against the Use of State Property.*—According to the Law of the Chow dynasty, all mountains, rivers, forests and mines were publicly owned and were prohibited from private exploitation. This prohibition would be lifted and the people would be allowed to enjoy the products of the state property.

(6) *The Abandonment of Trade Restrictions.*—Although there were no customs duties in the Chow period, inspections and restrictions were in force on both imports and exports between states. These would be abandoned in times of depression to facilitate free transportation and quick exchange.

(7) *The Elimination of Social Ceremonials.*—This is a measure of social economy and thereby unnecessary expense would be saved for necessary purposes.

(8) *The Simplification of Funeral Rites.*—The Chinese often overdo funeral and burial services.

(*Concluded in previous column.*)

The Manufacture and Physical Properties of Nickel-Copper-Chromium Austenitic Cast Irons.*

Many of the properties of the nickel-copper-chromium austenitic cast irons, now familiar to engineers in this country under such names as "Ni-Resist" and "Nimol," have been discussed at length in our columns.

The purpose of the present article is to give rather more detailed information on "Ni-Resist" and particularly on its manufacture and fabrication.

Composition.

The range of composition generally adopted for most applications is as follows:—

	Min. Max.	Recommended.
	Per cent.	Per cent.
Total C.	2.7 to 3.2	3.0
Si	1.0 to 2.0	1.5
Mn	0.8 to 1.5	1.0
S	— 0.12	0.1
P	— 0.4	0.2
Ni	12.0 to 16.0	14.0
Cu	6.0 to 8.0	7.0
Cr	1.5 to 4.0	2.0

These compositions apply to average sections ($\frac{1}{4}$ in. to 1 in.). For sections above 2 in., in order to ensure free machinability, it is desirable to increase the nickel content by a further 2 or 3 per cent.

When the presence of copper is undesirable, as, for example, when the alloys are to be used in contact with foodstuffs, it may be replaced by an equivalent proportion of nickel and incidentally a superior alloy will result. Chromium is generally included in the alloys to improve strength and hardness, whilst the higher proportions of this element are recommended when the castings are required for heat-resisting purposes.

Chromium additions rapidly increase the hardness of the alloy, and with 5 to 6 per cent. of this element the fracture becomes white due to the presence of chromium carbide. If the nickel content is increased, however, higher proportions of chromium can be carried without impairing machinability, and alloys containing as much as 10 per cent. of chromium with 30 per cent. of nickel, are in regular use on account of their superior corrosion-resisting properties.

Fig. 1.—The Structure of Ordinary Cast Iron, showing Graphite Flakes and Pearlitic Matrix. Light-Coloured Areas consist of Phosphide Eutectic. × 500.

* Based on matter supplied by the Bureau of Information on Nickel.

Methods of Manufacture.

"Ni-Resist" consists essentially of an alloy of cast iron with "Monel metal" with further additions of such elements as chromium. The alloy may be made up by any of the usual melting processes adopted for cast iron. Any good quality of cast iron, in the form of pig or scrap, which will give a final composition within the limits indicated above is suitable for the purpose. As a rough guide, however, the following is given as a suitable approximate composition for the base iron.

Total C.	3.3 to 3.5 per cent.
Si	1.4 to 2.25 ,,
Mn	0.5 to 1.2 ,,
S, not over	0.08 ,,
P, not over	0.5 ,,

The nickel and copper may be added either as separate addition in any suitable form, or as an alloy such as "Monel metal." For the convenience of foundrymen, however, arrangements have been made with Messrs. Henry Wiggin & Company, Limited, Thames House, Millbank, for the supply of special alloy ingots known as N.C.C. (nickel-copper-chromium) pig which contain the special elements in the required proportion.

An approximate composition of N.C.C. pig is as follows:—

Ni	56 to 58 per cent.
Cu	24 to 26 ,,
Cr	6 to 8 ,,
C	0.5 ,,
Si	0.5 ,,
Fe, etc.	Balance.

It will be seen that the use of one part of this pig to three parts of iron will give approximately the required composition, no allowance being necessary for the loss of copper or nickel.

N.C.C. pig is available in a convenient form consisting of small ingots of about 5 to 7 lbs. in weight.

Whatever method of making up the alloy is adopted, it is possible that some minor adjustments in composition will be required, particularly in respect of chromium and manganese, some of which may be lost by oxidation. These materials may be added in the usual forms in the cupola or other melting furnace but, if desired, small proportions may be added in the ladle to effect final corrections in composition.

It must be emphasised that the "Ni-Resist" type of iron cannot, as in the case of low-alloy cast irons, be made up by means of cold-ladle additions alone. "Ni-Resist" may be manufactured in almost any existing melting plant. For small quantities of metal the crucible type of melting is most convenient, as it offers a perfect control over composition and prevents contamination of the metal. In this case the required amounts of pig-iron and alloy additions may be melted together in the crucible, the whole stirred, allowed to stand and skimmed before casting. A similar method of procedure may be adopted if an open-hearth or rotary type of furnace is available.

In the case of cupola additions, the alloys should be charged in the centre of the pig-iron, and every care taken to ensure isolation of the special "Ni-Resist" charges from any other metal which may be passing through the cupola, since failure to attain a correct composition leads to hard, unmachinable castings.

"Ni-Resist" charges may often be used as the first metal melted, since they are not likely to suffer from carbon pick-up, and the separation of the "Ni-Resist" from the more ordinary metal is thus assisted.

A method which is sometimes adopted for small to medium size castings is to melt the N.C.C. pig separately in a gas- or oil-fired crucible furnace (the melting point of the pig is relatively high and a coke-fired furnace may prove inefficient), and to add it in the molten condition to the ladle of iron tapped from the cupola or other melting furnace.

Fig. 2.—Austenitic Cast Iron, showing Graphite Flakes in Homogeneous Corrosion-Resistant Matrix. × 500.

In making up "Ni-Resist" a proportion of scrap returns may be used, but it is usually advisable to restrict this material to about 25 or 30 per cent. of the charge, as it proves difficult with greater amounts to maintain the total carbon at a sufficiently high level to ensure free machining.

Fig. 3. — Mixed Austenite-Martensite Structure, resulting from too Low a Content of Nickel and Copper. × 500.

Casting "Ni-Resist."

Pattern shrinkage allowances should be slightly greater than for ordinary cast iron, an allowance

of $\frac{5}{32}$ in. per ft. being generally suitable, but a figure as high as $\frac{3}{16}$ in. is sometimes necessary. Patterns as for ordinary iron may therefore be employed in the case of small castings, but for larger sizes it will be desirable to make suitable allowances for the greater shrinkage of "Ni-Resist."

Fig. 4.—The Valve Body in "Ni-Resist" illustrates the Good Foundry Qualities of this Metal, since Clean Pressure-Tight Castings are essential, whilst the Iron must at the same time be readily Machinable.

With care "Ni-Resist" may be poured at ordinary cast-iron temperatures, but in view of its low carbon content and consequent short freezing range, a slightly higher temperature should be employed if possible, and small castings may be poured with advantage as hot as 1,300 to 1,350 deg. C. Moulding sands as normally used for cast iron are suitable for "Ni-Resist," but on account of the short freezing range, runners, gates and risers should be cut on the liberal scale, allowances such as are usually made in aluminium alloy casting practice being found successful.

If chaplets have to be used, they should be made of "Monel Metal," since those in ordinary iron will be liable to cause hard (martensitic) spots and, by introducing spots liable to attack, will seriously impair, if not destroy, the corrosion resistance of the castings. As "Ni-Resist" does not harden on rapid cooling, the castings may be "knocked out" as soon as solid and allowed to cool in the air. If the above instructions are carefully followed, the "Ni-Resist" castings should be uniformly machinable and free from any such troubles as blow-holes and porosity. The alloy is, in fact, being used successfully in a variety of pressure castings.

Machining of "Ni-Resist."

A fully-austenitic cast iron is generally soft and easily machinable. Owing to the phenomenon of surface hardening on working, however, machining speeds are generally lower than for an ordinary cast iron of similar hardness, and a Brinell hardness of about 200 often represents the limit of commercial machinability.

A deficiency of austenite-forming additions (nickel or "Monel metal") leads to the formation of a mixed structure (see Figs. 2 and 3) which is accompanied by higher hardness. Although this mixed structure has its uses (*e.g.*, in castings for resisting erosion), it increases the difficulty of machining. As in the case of manganese steels, better results may be obtained on machining if the bold course is adopted and a deep heavy cut used, this being successful under conditions where a light cut causes hardening, the tool then merely riding over the surface of the metal. With a suitable composition, the metal is fine grained, and, after machining, takes on a very fine polish, which is maintained indefinitely in a dry indoors atmosphere, owing to the rust resistance of this iron.

Castings which prove harder than desired may often be softened by heat-treatment. Hardness may be due to a deficiency of alloys, as discussed above, this being specially marked under slow cooling conditions, as in large lumpy castings. Such hardness may be corrected by heating the casting to about 950 deg. C. and soaking (say 15 min. for each inch of section), followed by quick cooling, this being brought about by cooling in an air blast or even by quenching in some mild medium such as oil. It must be remembered, however, that a casting so softened will be liable to give trouble with surface hardening on machining.

Welding of "Ni-Resist."

"Ni-Resist" may be readily welded by the arc or acetylene processes, using filler rods of "Ni-Resist" composition or "Monel-metal" rods, either of which give a soft machinable weld. Ordinary cast-iron or steel rods must not be used.

The appearance of "Ni-Resist" is very similar to that of a fine-grained grey cast iron. In a good casting made from cupola metal its tensile strength will be about 15 tons per sq. in., though higher figures are readily attainable by using special precautions. The metal shows a certain measure of ductility, 2 or 3 per cent. elongation often being recorded in the tensile test; this introduces an element of toughness in the castings, much superior to that found in ordinary cast iron. In certain sections of castings the ductility of the metal may be increased by using a suitable composition and subjecting the casting to a simple annealing treatment.

The hardness of the metal may be varied at will by control of composition, especially with regard to chromium. An average casting will give a figure of about 180 Brinell, but figures as low as 120 Brinell may readily be obtained if chromium is reduced to the minimum. With higher chromium the hardness (associated with a white-iron structure) may be increased to as much as 400 to 500 Brinell.

The microstructure of an austenitic cast iron is shown in Fig. 2, as compared with an ordinary cast iron (Fig. 1). Fig. 3 shows the mixed austenite-martensite structure which results from a deficiency of nickel or nickel plus copper.

Other physical properties of "Ni-Resist" are indicated below:—

Specific Gravity	7.6
Thermal Coefficient of Expansion. Room temperature to 600 deg. C.	18×10^{-6}
Thermal Conductivity	0.08

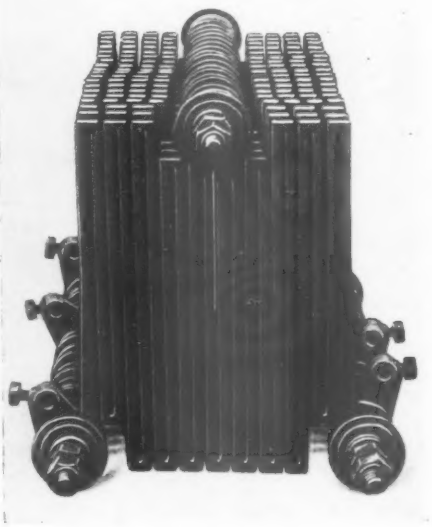


Fig. 5.—"Ni-Resist" has proved eminently suitable for Resistance Grids, due to its High Electrical Resistance, its Low-Temperature Co-Efficient of Resistance and its Non-Magnetic Properties. The Thin Sections involved in the Grid Castings further Testify to the Foundry Quality of the Alloy Cast Iron.

"Ni-Resist" is particularly useful in high-temperature applications, on account of its superiority over cast iron in retaining its strength and being immune from growth. After 30 days' intermittent heating at 600 deg. C. "Ni-Resist" showed a loss in strength of only 3 per cent., accompanied by an increase in volume of only 0.4 per cent.

Tensile tests at elevated temperatures show that "Ni-Resist" holds its strength to a remarkable extent. At 450 deg. C. the strength is only 2 tons less than at room temperature and at 700 deg. it still retains 50 per cent. of its strength.

(*Concluded on page* 354.)

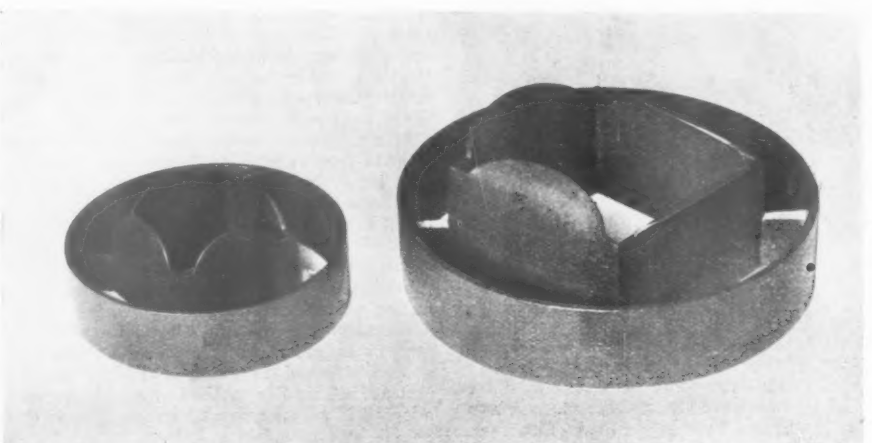


Fig. 6.—Roller-End Castings in "Ni-Resist," illustrating the Fluidity of the Metal and its Suitability for Thin-Section Castings. Annealing at 950 deg. C. for 1 Hour has rendered the Thin Tangs Malleable.

The Technical Committee and Technical Developments in Connection with the Institute.

By T. R. Walker.

In 1930 the General Council came to the conclusion that from a technical point of view the activities of the Institute were somewhat inadequate, especially when the Institute was compared with other scientific and professional bodies. It was therefore decided to set up a Technical Committee. One important object was the co-ordination of information relating to foundry matters.

Underlying Principles.

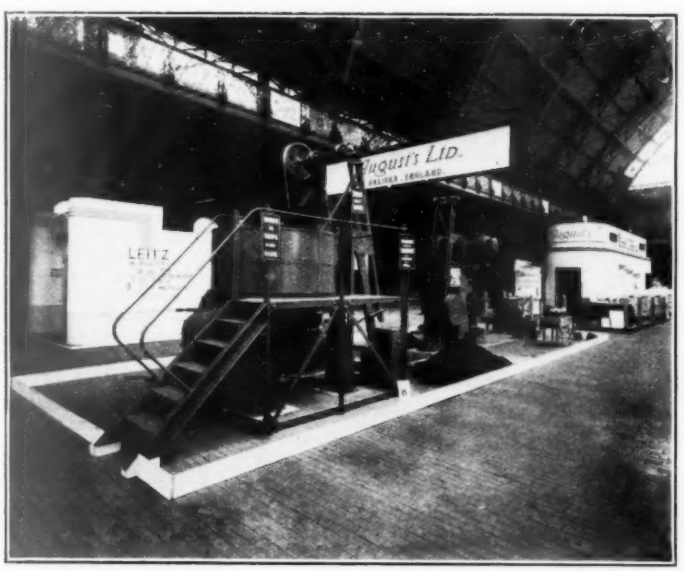
Nowadays it is increasingly difficult for any one person to be acquainted with the whole field of technical information in any particular subject. When the World's List of Scientific Periodicals was published in 1927, it was found that over 25,000 different technical and scientific periodicals were being published. Since then the number has increased. Naturally, all these do not contain matter having a direct connection with foundry practice, but the amount of literature published which has some bearing on the work of the foundry is nevertheless enormous. It was also intended that the Technical Committee should act as a liaison between the Institute and kindred scientific and technical bodies, including research organisations. It is quite clear, for example, that two or more investigators might be simultaneously attacking the same problem, and if they were brought into contact, it would be a great advantage, and also would be likely to save a good deal of time and money.

It was felt that the Technical Committee would be able to see what lines of research were being pursued, and assist by advice or otherwise those engaged in research likely to be useful, or indicate avenues for investigation likely to give useful information. It was also thought that in some cases the Technical Committee might itself institute research or investigation into particular problems, but without any idea of competing with any similar work already being carried out by other bodies. It was also hoped that the Technical Committee would be able to make a good deal of information available for the ordinary members, whether this was derived from results already published but scattered, or whether it was the outcome of the Committee's activities.

Personnel.

The Committee as originally formed, consisted of two elected members from each Branch. These met and immediately decided to divide themselves into a number of Sub-Committees each dealing with one phase of foundry practice. The original Sub-Committees were very small, and it was early decided to co-opt other members in each Sub-Committee, the co-opted members being individuals who had specialised in the particular activity covered by the Sub-Committee, and who were therefore likely to bring some useful information and experience to bear on the work of the Sub-Committee. It was also decided that these co-opted members should not necessarily be members of the Institute, since a restriction of this nature would naturally exclude some men who would be very valuable to each Sub-Committee.

The Exhibit of the Technical Committee of the Institute of British Foundrymen at the Recent Exhibition.



The Exhibit of August's, in addition to showing Foundry Equipment, had a Small Cinema Show.

Specifications.

One of the first duties which it was felt that each Sub-Committee should assume was the collection of published specifications for the materials involved. These specifications are issued by all kinds of authorities such as Government departments, railway companies, inspecting engineers, automobile manufacturers, and various others, including such bodies as the British Standards Institution. Frequently the specifications for similar material vary but slightly, and several could easily be incorporated in one single specification. Sometimes, however, the specifications for the same or very similar materials demand substantially different properties. It was considered that an extremely useful piece of work would be the co-ordination of such specifications as could be obtained, with a view to standardising the more important ones, and simplifying the whole position by eliminating specifications which were either badly drawn up or varied only slightly from some standard specification already widely adopted.

It was soon found that from this point of view alone the work of the Sub-Committee was likely to prove very different. In ferrous metals, for example, the multiplicity of specifications is very considerable, while for sands and refractories practically no specifications at all were available.

Considerable progress has already been made in the correlation of specifications by different Sub-Committees. As regards the publication of the work done by the Sub-Committees, a *résumé* of the work of the Malleable Iron Sub-Committee was read at last year's Conference at Newcastle, and a Paper relating to the work of the Sands and Refractories Sub-Committee will be read at this year's Conference at Cardiff.

Available Data.

Other work on which the Sub-Committees are engaged is the tabulation of physical data for cast iron and non-ferrous materials, the size and shape of test-bars for cast iron, malleable iron and non-ferrous metals, and the results of practical determinations on the contraction of castings. The Cast Iron Sub-Committee in addition is engaged on the standardisation of photomicrographs as regards magnification. In due course it will no doubt publish standard photomicrographs illustrating different types of irons having

different structures. In August, 1931, it was decided to issue to members a monthly list of references to technical foundry literature. It has recently been considered, however, that the members to whom such a list was of interest were already well served in this respect by lists and abstracts published by other organisations, and it has therefore been decided to discontinue the publication of the Institute's own index.

Information Bureau.

A feature recently introduced by the Technical Committee is the establishment of an Information Bureau for the use of members generally. It is now possible for members having any particular technical difficulty to apply to the Technical Committee for assistance. Naturally, it would not be expedient to publish all the replies, but such as are of general interest will be published in The Foundry Trade Journal.

The Technical Committee also arranged to have a stand at the recent International Foundry Trades' Exhibition, on which exhibits illustrating the work of the various Sub-Committees were shown. These included, for example, different types of castings, different methods of manufacture, different structures of metal obtained in various ways, as shown by microscopic examination, various refractory materials and different methods of testing sands.

Educational Activities.

The education of the foundry worker in subjects having particular reference to foundry technique has been somewhat neglected in this country until just recently. In view of this, the Institute initiated examinations in Foundry Practice and Science, a syllabus being arranged in conjunction with the Institution of Mechanical Engineers and the City and Guilds Institute. The examinations are conducted under the auspices of the City and Guilds Institute, and the first of these was held in April last. The response from technical colleges and other educational institutions was very promising, in that a large number undertook to arrange special courses for the examination, and it is hoped that increasing numbers of foundry workers will enter for this examination. It is intended that in time the holding of these certificates will be a recognised hall-mark for the foundry worker. A more advanced scheme of foundry education was outlined by Prof. Andrew at the last meeting of this Branch, and has received a most encouraging reception. In this case it is intended to have a special foundry degree course at Sheffield University. This will be the first University course carrying an academic qualification to be established in this country.

Modern Requirements.

In spite of increasing competition in the manufacture of articles by drop forging, forging and fabrication by welding, it is certain that foundries will be an essential feature in engineering practice for a very long time so that there will always be a demand for well-trained foundry managers. A defect which has occurred very extensively in foundry management and is in fact very prevalent, is that if a foundry manager has been trained in the moulding or the pattern shop, his knowledge of metallurgy is usually small, while if he has been trained as a metallurgist or steel maker, his practical knowledge of moulding and pattern making is often very slight. It cannot be denied that the ideal foundry manager would possess a thorough knowledge both of the practical work in the foundry and of the fundamental mechanical and scientific principles involved. This aspect of foundry training has not been overlooked in the proposed new course, as in it the student will do practical work in the foundry and attend classes at the university alternately. For such a scheme to be successful it is essential for it to be regarded favourably by the firms having foundries, so that the time spent by the student in the works could be allocated most profitably. Naturally, however, it is to the firm's interest to provide the best technical training it can as the provision of well-trained foundry managers would be a benefit to the industry at large. It is not to be expected that large numbers of students would enter for this course, indeed it is scarcely desirable, as until substantial improvement in trade takes place in this country, the number of vacancies for young foundry managers will not be very large.

From a technical point of view, Sheffield must be regarded as being very fortunate, since in addition to the proposed foundry degree course, special classes are held at the University for the technical certificates in Foundry Practice and Science. In addition there is a Foundry Trade Technical Society and a branch of the Institute in the city. This combination occurs in no other place in the country.

Sand Testing.

In the case of sands, as already pointed out, there are practically no specifications available. This is due to the fact that the study of the properties of foundry sands is of very recent growth. It is only within the last few years that systematic examination of the properties of foundry sands has been undertaken. The methods of examination of foundry sands are not yet the same in different countries, and scarcely any piece of apparatus employed in sand testing has received universal acceptance. It is a fact, indeed, that differences of opinions are held regarding the relative importance of the several properties of moulding sands.

Considering steel-foundry sands in particular, however, it is generally agreed that the most important properties are its refractoriness, mechanical strength and its permeability. Mechanical strength depends not only on the bond present, but also on the water content and on the density to which the sand is rammed. The permeability is also influenced by the water content and ramming density, as well as by the grain size of the sand. The water content and rammed density must therefore be included in the properties to be quantitatively determined. The chemical analysis can be carried out in any ordinary laboratory. The grading of the sand particles is easily done, but even here there is no universally-accepted method of recording the results. At this point a distinction must be drawn between the examination of sands for foundry-control purposes, and their investigation from a research point of view.

Standardisation Lacking.

For the control of sand in use in the foundry, the methods must be quick, with as great an accuracy as can be secured in a short time. In research work, on the other hand, the methods used should be founded on accepted scientific principles, and accuracy is far more important than the time taken. The Sands and Refractories Sub-Committee has decided that the standardisation of methods suitable for the control of sand actually in use in the foundry would be of more immediate value to the foundry industry than the initiation of investigations regarding the properties of sands from the research point of view, and its activities have therefore been concentrated in the former direction.

The amount of water present as such in a sand can be determined in any laboratory in about an hour. For foundry-control purposes, however, especially for green-sand working, this is far too long a time, and methods promising results in a few minutes are being investigated.

Divergent Views.

The mechanical strength of a moulding sand is very different in the green and in the dry states: the sand has, in fact, properties which are substantially different in the two states. When dry it is brittle material, resembling in many respects concrete, while in the green state it is partly brittle and partly plastic in nature. It does not follow, therefore, that the same methods would be equally suitable for testing green and dry sands, and here we shall consider only the green strength. The mechanical strength may be determined by tensile, compressive or torsional methods. The apparatus required and the skill in its manipulation demanded for the determination of the green strength of a sand in tension or torsion, preclude the use of these tests for foundry-control purposes. Ramming a cylindrical sand specimen and then applying pressure axially until it collapses are both easy. In practice, however, the results vary, not only with the method of ramming and the density to which the sand is rammed, but also with the ratio of length to diameter of the specimen. The specimen adopted by the American Foundrymen's Association is a cylinder 2 in. by 2 in. with its height equal to its diameter. That recommended by the B.C.I.R.A. is a cylinder 2¼ in. long by 1¼ in. dia., with its height twice its diameter. When such specimens are loaded, the resistance of the sand to compressive stresses and its resistance to shear stresses are both involved, in proportions which vary with the dimension ratio of the test-pieces. For all these reasons the standardisation of a green-strength test is not an easy matter.

Permeability Determinations.

The permeability of a sand to the passage of gases is naturally best tested by actually passing gas through the sand. The time taken for a given volume of gas at a standard pressure to pass through a sand specimen may be taken, or alternatively, the back pressure set up by the resistance of the sand to the passage of gas through it may be determined. The sand specimen used by the A.F.A. is a cylinder 2 in. dia. and 2 in. long, and the time required for one or two litres of air to pass through the specimen at a standard pressure is determined. The ramming of the specimen is carried out according to a standardised procedure. In the B.C.I.R.A. apparatus the permeability specimen is a cylinder 20 cm. long with a cross-sectional area of 40 sq. cm. and coal gas is passed through the specimen at a standard pressure until it ignites at the other end, the time necessary for this being noted. Some experimenters take the time as that which elapses before the mixture of gas and air explodes at the exit. Others take the time required for the gas to burn quietly. The difference in open sands is little, but for close sands is quite appreciable. In this apparatus the sand is rammed by any convenient method for different relative densities, while in the A.F.A. apparatus the same sand is rammed to one density only. Before any comparison of results by the two methods, therefore, the relative density of the sand as examined must be adjusted to the same value in each case. With the A.F.A. apparatus it is also possible to measure the permeability by determining the back pressure set up when the air is admitted to the specimen through two standard orifices. This method, however, is probably less accurate than the ordinary method of the timing the passage of a given volume of air through the specimen. Experiments are being carried out by the Sands Committee to investigate the correlation of the results obtained by the A.F.A. and B.C.I.R.A. apparatus, and also by other forms of permeability apparatus.

The position of permeability testing from a foundry-control point of view is complicated by the fact that in different foundries different water contents and different ramming densities are employed, both of which influence the permeability of a sand considerably.

It is clear from the above that the testing of foundry sands is far from being in a satisfactory condition at present, and that a good deal of further work is necessary before reasonable specifications can be drawn up which would be of use in regularising the supply of foundry sands.

The Open-Hearth Process for Steel Castings Production.*

By W. H. Thompson.

The open-hearth process, whilst not so flexible as some steel-making processes, can be developed into a very useful and economic process for meeting the steel requirements for a modern foundry producing the larger types of castings up to 25 tons in weight; the capacities of the furnaces in commission at the author's works being 20 and 25 tons respectively. Whilst it would be unwise to dogmatise as to which open-hearth process is the most suitable for the manufacture of steel, for larger types of steel castings neutral steel has given far superior results in Lloyd's Foundry than either acid or basic open-hearth steel.

The quality of steel for major castings is a very important factor, and every possible precaution must be taken to ensure that each heat of steel is of the desired standard, as rejections or waster castings will incur considerable expense and delay. The term "neutral" is used in this Paper to define a process which is intermediate in its general features between the acid and basic processes.

Casting Properties.

The characteristics of the steel made from these processes, in so far as regards their casting properties, are:—

Acid Steel.—This generally is much hotter than basic, and retains its heat for a much longer time; it has greater fluidity, but undoubtedly is very prone to hot tears and cracks, especially with castings of complicated sections, even though the sulphur and phosphorus does not exceed 0.05 per cent.

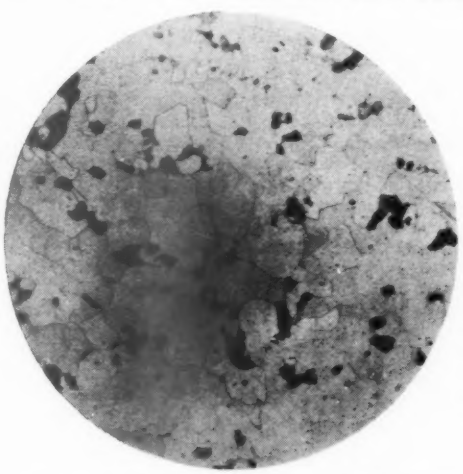


Fig. 1.—Microstructure of Neutral Steel containing C 0.44, Si 0.10, Mn 0.25, S 0.035 and P 0.024. It gave MS 25.4 tons and YP 16.0 tons per sq. in., 35 per cent. E and 53 per cent. RA, with Bend Angle of 180 deg. U. × 100.

Basic Steel.—Much less prone to hot tears and cracks; it is more oxidised with consequent danger of blowholes or unsoundness, and must be poured without delay to avoid lapping or cold shuts, etc.

Neutral Steel.—This is made from acid quality materials, namely hematite pig-iron and scrap with low sulphur and phosphorus content on a basic-lined furnace. It gives fluidity, freedom from hot tears and cracks, and by virtue of the low oxide content there is no danger of unsound steel.

There are no particular special features in the design of the furnaces, with the exception of the rather high chimney stacks; actually a 120-ft. stack for the 20-ton furnace, and 150-ft. stack for the 25-ton furnace, the available stack draft being 1.5 in. and 2.0 in. water gauge respectively. This process is not severe on the furnace lining, and, with reasonable care, the life of a furnace is from 8 to 9 months, which is equivalent to good acid practice, and a longer life than average basic practice. Typical charges for neutral steel heats consist of 25 to 30 per cent. of hematite pig-iron, containing: Si, 2.0; Mn, 3.0; S, 0.025, and P, 0.025 per cent.; and 75 to 70 per cent. of steel scrap: Si, 0.25; Mn, 0.75; S, 0.05, and P, 0.05 per cent.

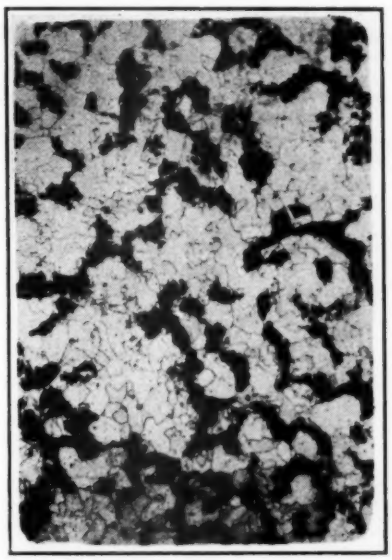


Fig. 2.—Micro of Neutral Steel containing C 0.18, Si 0.25, Mn 1.14, S 0.034 and P 0.027. It gave MS 31.4 tons, YP 18 tons per sq. in., 35.6 per cent. E and 54.2 per cent. RA, and Bend Angle 180 deg. U. × 100.

Fig. 3.—Micro of Neutral Steel containing C 0.23, Si 0.27, Mn 0.60, S 0.032 and P 0.018, which gave MS 32.2 tons, YP 17 tons per sq. in., E 30 and RA 50.8 per cent., with a Bend Angle of 180 deg. U. × 100.

These charges have an initially low sulphur and phosphorus content; a slight excess of gas is carried in the flame during melting to avoid over-oxidation when melted. The iron oxide content of the bath can then be kept under control, and weighed additions of ore are made to boil out the excess of carbon, etc. Typical analyses of slags are set out in Table I.

Table I.—*Composition of Slags when making neutral Steel.*

	Melted.	Tapping.
	Per cent.	Per cent.
Silica (SiO_2)	29.7	19.5
Oxides of iron (FeO) (Fe_2O_3)	10.2	8.4
Manganese oxide (MnO)	11.8	8.9
Sulphur (SO_3)	6.25	0.36
Phosphorus (P_2O_5)	0.45	0.40
Lime (CaO)	40.60	51.70
Magnesia (MgO)	5.50	6.50
Colour dark brown, and fairly viscous	Colour brown, and viscous.	

The rate of carbon fall during the boil is 20 to 30 points during first hour, and 10 to 15 points for last hour of boiling period.

By means of a slag tap hole, the first slag may be run off, and a reducing slag added, which is a highly-lined slag reduced with additions of finely-divided anthracite or other suitable carbonaceous material, fed on to the surface of the slag. This carbide slag reduces the iron oxide content in the slag to 1 per cent. or under, which is comparable to electric-furnace practice.

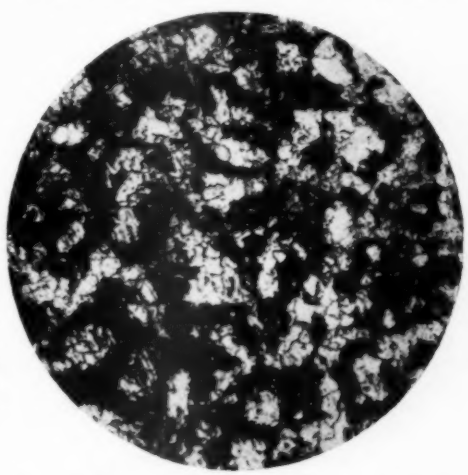


Fig. 4.—Micro of Neutral Steel containing C 0.30, Si 0.26, Mn 0.75, S 0.03 and P 0.02 per cent., which gave MS 34.6 tons, YP 17.8 tons per sq. in., E 31 per cent. and RA 49.6 per cent., with a Bend Angle of 180 deg. U. × 100.

Casting Practice.

The tapping temperature is 1,600 to 1,640 deg. C., and casting temperature 1,520 to 1,550 deg. C. All the castings are bottom-poured from the ladle, and the size of nozzle used is varied according to the size of castings. Casting speeds of 35 to 40 cwts. per minute may be used without the danger of cracks, etc.

Heat-Treatment.

The annealing temperature is varied according to the carbon content of the steel, and is standardised at 950 deg. C. for 0.25 per cent. carbon and under and at 880 deg. C. for steels of 0.30 to 0.50 per cent. C. Castings up to 3-in. thick section are heated up to temperature in 7 to 8 hours, and allowed to soak at this temperature for 5 hours, and castings above 3-in.

* A Paper read before the Birmingham, Coventry and West Midlands Section of the Institute of British Foundrymen, Mr. J. G. Pearce presiding.

XUM

thick section are heated up to temperature in 9 to 14 hours, and soaked at this temperature for 6 to 10 hours. After soaking for required period, the castings are cooled down to 680 deg. C., reheated to 850 deg. C., soaked for two

Fig. 5.—Micro of Neutral Steel containing C 0.40, Si 0.27, Mn 0.75, S 0.035 and P 0.024, which gave MS 44 tons, YP 26, E 18.5 per cent. and RA 32 per cent., with a Bend Angle of 120 deg. U. × 100.

hours, and allowed to cool down in the furnace. Castings which are required to meet special conditions are quenched and tempered. These treatments produce superior mechanical properties to castings in the annealed condition.

The microstructure and mechanical tests of neutral steel shown in Figs. 1 to 5 are average results from test-pieces which are cast on the castings, and have had the ordinary works annealing. They show an even distribution of the pearlite and complete coalescence of the excess ferrite.

Figs. 6 to 9 show microphotographs and mechanical tests of a quenched and tempered steel and form an interesting comparison. The

Fig. 6.—Micro of Basis Steel in As-cast Condition. × 100.

composition in this case is C, 0.31; Si, 0.24; Mn, 1.33; S, 0.036, and P, 0.036 per cent. This steel and Nos. 3 and 4 treatments are used for castings where wear and shock-resisting properties are required.

DISCUSSION.

On the motion of Mr. G. M. Callaghan, seconded by Mr. J. H. D. Bradshaw, Mr. Thompson was heartily thanked for his address. Mr. Callaghan said the small attendance seemed to indicate that many members did not feel that a general knowledge of other metals than that with which they happened to be concerned was going to be useful to them.

The President also expressed regret that there were not more "grey-iron" men present. He often felt, he said, that if "grey-iron" men would come and learn something about steel founding they would go home thanking their stars that they had got a soft job. He would like to know whether the production of acid steel in a basic-lined furnace was confined to the works which Mr. Thompson represented. He confessed that to him (the President) it was a novel method of production. Perhaps Mr. Thompson would also inform the meeting how the bend test was made—whether by pressure or hammering.

Mr. Thompson, in reply to the President, said that so far as he knew the neutral process was only being used by one other firm, and in their case it was being used for ingot manufacture and not steel castings. The bend tests were done under pressure.

Mr. Bradshaw said Mr. Thompson had mentioned that the West Coast hematite used had

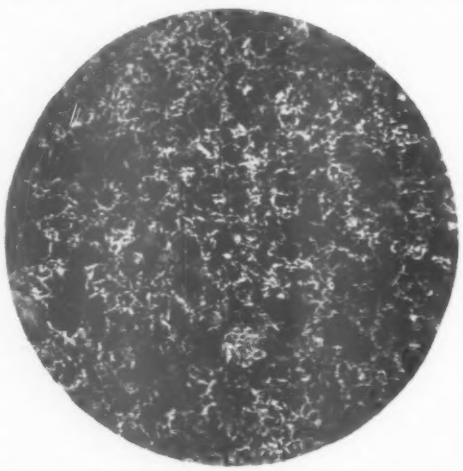


Fig. 7.—Micro of Steel shown in Fig. 6 after Heating to 920 deg. C. and Cooling in Air. It gave MS 50 tons, YP 33.6, E 10.5 per cent. and RA 16.6 per cent. × 100.

a manganese content of 3 per cent. That seemed a very high content for a West Coast hematite.

Mr. Thompson agreed. It was a special iron, he explained.

Mr. W. J. Molineaux, referring to the special steel used for making castings with widely varying sections, said the analysis seemed fairly normal, with the exception of manganese—1.1 per cent. Was it due to the high manganese, he asked, that it was possible to get sound castings?

Mr. Thompson said that did help.

Asked what were the disadvantages, Mr. Thompson replied that in the as-cast condition the steel was very brittle.

Mr. Thompson was also asked if he considered the use of acid materials in a basic-lined furnace unduly shortened the life of the furnace. He replied that the practice was not unduly severe upon the furnace lining. With acid steel, he said, the normal life was eight or nine months, while basic steel was doing very well if they ran for a period of six months without going down for repairs. There were three heats a day.

Mr. Callaghan mentioned an instance of imitating steel-castings practice in the case of grey iron, with satisfactory results. He had noticed, he said, that in producing globe valves in steel it was the usual practice to put a very large riser over the top of the seating on the top of the globe. He adopted this method and had completely got rid of waste.

Commenting on the brittleness of steel containing a high percentage of manganese. Mr.

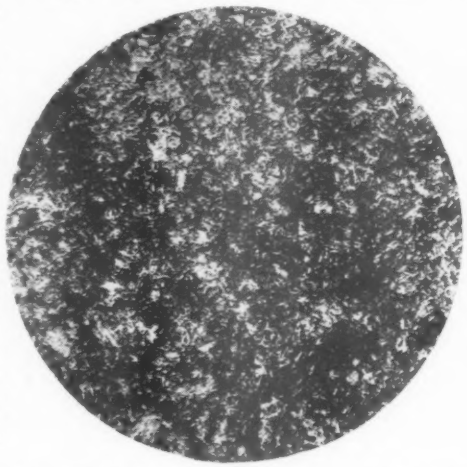


Fig 8.—Micro of Same Steel after Heating to 850 deg. C. and Quenching in Water, and Tempering at 650 deg. C. and Cooling in Air. It gave MS 46.8 tons, YP 38.4, E 13.5 per cent. and RA 21.6 per cent. × 100.

Thompson said it was a steel which must be heat-treated to obtain the maximum mechanical qualities. Normalised, the brittleness was removed and considerable strength was obtained, but comparatively low ductility. By quenching in water and subsequent tempering they got reasonable ductility and strength.

The President said it was a great pleasure to hear that steel of the quality described was being obtained in casting form as a regular practice and he thought it augured well for the future of the British steel-castings business. It was particularly interesting that this should be going on not in the historic centre of steel founding—Sheffield—but in the Birmingham district. They were greatly indebted to Mr. Thompson for giving them the benefit of his experience, and putting his cards on the table.

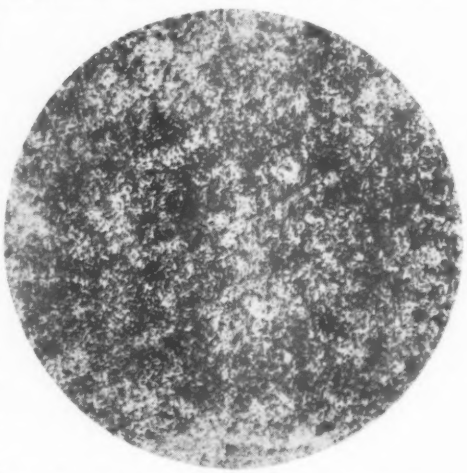


Fig. 9.—Micro of Same Steel after Heating to 850 deg. C. and Quenching in Water, and Tempering at 650 deg. C. and Cooling in Water. It gave MS 47.2 tons, YP 38.8, E 20.5 per cent. and RA 35 per cent. × 100.

It was one of the great features of the Institute that men were willing to come forward and give the results of their experience, which had taken years to acquire, in an open way.

Institute of British Foundrymen.

SCOTTISH BRANCH.

Annual General Meeting.

The Annual General Meeting of the Scottish Branch was held in the Royal Technical College, Glasgow, Mr. H. D. Campbell (Branch-President) in the chair. The annual report of the Council for the session, together with the financial statement for the year ending December 31, 1932, was presented by the Secretary, and abstracts are given below.

During the session, and excluding the annual business meeting, six regular meetings of the Branch has been held in Glasgow. The highest attendance was on November 5, when there was an attendance of 97, including 50 members and 47 visitors. The lowest attendance was 40, which included 29 members and 11 visitors, and the average for the session was 46 members and 19 visitors. For the previous session the highest attendance was 72, the lowest 42, and the average 62, represented by 51 members and 11 visitors.

In addition to the meetings held in Glasgow, four meetings were held in Edinburgh, at which the average total attendance was 42. The meetings in the capital are still in the nature of propaganda meetings, and while there has been a fair attendance of members from the West, there is no doubt about the interest shown by the members resident in Edinburgh and the East of Scotland generally. The local committee, under the able chairmanship of Mr. William Wallace, are keen on the work, and with the addition of Mr. A. D. Kirkby from Leven, all the members have been re-appointed for the session 1933-34.

It is gratifying to be able to record also that the Falkirk Section has had a good session. Reference was made in the last report of their unfortunate experience in session 1931-32, and the hope was expressed that 1932-33 would show a decided improvement. The Falkirk committee, with Mr. Thomas Shanks as President, and with Mr. Morrison as secretary, have justified this hope, and we anticipate still better times for them in the coming session.

During the session an interesting event occurred, when the section transferred their meeting place from the works of the Falkirk Iron Company, Limited, to the New Technical School which has been erected in Laurieston Road, Falkirk. In view of its position as the centre of the light casting industry in Scotland, Falkirk has many foundry problems peculiar to that branch of the industry, and, although these may not be important to members dealing with the heavy side of the foundry trade, the local committee will welcome as many of the latter as can find it convenient to attend. The syllabus was, as usual, prepared to provide for the varied needs of membership, and the good attendances during these difficult times show that the efforts of the Council in this direction have met with general acceptance.

Once again we have to record the award of a diploma to a member of the Branch. On this occasion the recipient was Mr. Wm. Y. Buchanan, whose Paper on "Sand Testing in the Foundry" was recommended by the Branch Council. This decision was unanimously endorsed by the Literary and Awards Committee and the General Council, and Mr. Buchanan's name is now added to a long and growing list. It may be worth recording here that a further honour was conferred on Mr. Buchanan when the General Council requested him to prepare a Paper for the meeting of the Polish Foundrymen to be held during the current year.

Reference to this leads one to record that for the first time, apart from conventions and the like, an ordinary meeting of the General Council has been held in Scotland. This meeting was held in Edinburgh. It is hoped it will prove to be the forerunner of many others, and that the long neglect of our claims for occasional meetings of the General Council in Scotland has been permanently ended.

The appointment of an Advisory Committee to confer with the Education Committee of the Glasgow Corporation on patternmaking and moulding classes, has enabled the Council to develop another sphere of activity, in which it is hoped good work will be done for the Institute and for the industry generally. Already the committee has paid two visits to each of the schools in which foundry classes are held, and it is satisfactory to know that these visits have proved both helpful and acceptable to teachers and students alike. Through this committee also has come the opportunity of advising the layout of the foundry department in the new technical school which the Corporation are now building. Mr. Campion has been our most active member in this piece of work.

On May 14 a large company of members, by kind invitation of the directors, visited the works of Messrs. Glenfield & Kennedy, Limited, at Kilmarnock, where the work of the various departments was fully explained under the guidance of Mr. Bruce Ball, Mr. Harry Gardner, and members of their staff. At tea which followed, the supplementary prizes awarded in connection with the "Sir Archibald McInnes Shaw" Competitions were presented to the winners by Mr. Bruce Ball. Our thanks are due to the directors of Messrs. Glenfield & Kennedy, Limited, for their kindness in opening their works to our members, and also for inviting to the visit the young lads to whom the prizes were presented.

Adoption of Report.

The PRESIDENT said that, taking all things into consideration, he thought the report showed a very creditable conditions of affairs within the branch. It reflected the strenuous work of the Secretary. It was perhaps disappointing to have to admit a reduction in membership, but in the present time it could hardly be avoided.

MR. N. MCMANUS said that he thought the report was very satisfactory, bearing in mind the state of the trade and the large number of foundrymen who were either totally or partially unemployed. They must hope for an improvement before the time came for receiving another report. He had pleasure in moving the adoption of the report and also the financial statement. He also moved a vote of thanks to the auditors, Messrs. Hurst and Walker, for their services.

The PRESIDENT said that as that was the last meeting before the new Council came into office, he wished to take the opportunity of asking them to accord a vote of thanks to those who were retiring from office, viz., Messrs. Bain, Shanks and Lawrie. They had all given good service to the branch during their term, and he wished to thank them on behalf of the branch, and also on his own behalf, for the loyal support and assistance which they had given to him during the past year. He would specially mention Mr. Shanks, who had taken over the chairmanship of their Falkirk section and had done much to resuscitate it.

The following were elected officers for the forthcoming session:—

Branch-President.—Mr. J. Currie, North British Steel Company, Bathgate.

Senior Vice-President.—Mr. H. Hurst, Messrs. James Howden & Company, Limited, Glasgow.

Junior Vice-President.—Mr. D. Sharpe, Messrs. Walter Macfarlane & Company, Glasgow.

Members of Council.—Mr. R. Ballantine, Paisley; Mr. W. Y. Buchanan, Johnstone; Mr. J. B. McHugh, Glasgow, and Mr. A. C. Millar, Motherwell.

Representatives to the General Council.—Mr. James Affleck, B.Sc., Dr. J. W. Donaldson, D.Sc., Mr. James McArthur, Mr. N. McManus, M.B.E., and Mr. H. D. Campbell.

Representatives to Technical Committee.—Mr. A. Campion, F.I.C., and Dr. J. W. Donaldson.

Hon. Secretary.—Mr. John Bell.

The PRESIDENT said that his next duty was a very pleasant one—to present to Mr. W. Y. Buchanan the diploma of the Institute, which was awarded by the General Council for his Paper on "Sand Testing in the Foundry," given before the branch last session. The Paper had aroused a great deal of interest in the foundry trade, in fact it had caused more interest amongst foundrymen than any Paper he knew. Mr. Buchanan had been invited to write the first exchange Paper to the Polish Foundrymen's Association, which showed that his work was of more than ordinary interest, and the award of the diploma indicated that it was of outstanding merit. The President then handed the diploma to Mr. Buchanan.

Votes of Thanks.

MR. A. CAMPION then moved that the best thanks of the members be expressed to the President for his work during the session. He said that he not only had been most regular in attendance, but had also attended the meetings in Edinburgh. Although he had come to the end of his Presidency, he thought that his well-known interest in the work of the Institute was a good augury of his continued support of the branch. He also moved that the very best thanks of the members and an expression of appreciation of his continued and strenuous efforts on behalf of the branch be conveyed to Mr. Bell, the honorary secretary. It was largely due to his untiring efforts that the membership and financial status of the branch was what it was. He had told them that he was presenting the annual report for the eleventh time, and had referred to the desire to reach the 300 mark. It was to be hoped that Mr. Bell would be spared to present another eleven reports, and that on that occasion he would be urging them to pass the 600 mark.

There was also one other item he wished to include in the resolution, and that was to mention that they continued to be indebted to the Governors of the Royal Technical College for the provision of accommodation for holding their meetings. They had had the use of that room ever since the inauguration of the branch, and although it appeared at one time that next session they would have to find other accommodation, he was pleased to say that the difficulty had been overcome and they would continue to hold the meetings in that room. He therefore moved that the best thanks of the members be conveyed to the Governors for the use of the college room during the past session. They passed a similar resolution at the end of each session, and it was conveyed to the Governors through Mr. Stockdale, the college director. As many of them were aware, Mr. Stockdale was shortly retiring from office, and as this was the last occasion he would be the medium for conveying their thanks to the Governors, he suggested that they might include an expression of thanks to Mr. Stockdale for the help he had given them from time to time, and the hope that he would have a long and happy time in which to enjoy a well-earned rest.

The resolution, on being put to the meeting, was carried with acclamation.

At the conclusion of the business meeting a large number of films were shown illustrating "Metal Treatment by the Oxy-Acetylene Process," and were explained by Mr. Davy, of the Acetylene & Welding Consulting Bureau, Limited.

XUM

Refractories.

DEVELOPMENTS IN REFRACTORY MATERIALS.

Mr. Green's Paper* brought out several new developments in the production of refractory materials for the foundry industry. The discussion was opened by Mr. C. H. Kain, who said that it was his experience that silica refractories used in the foundry had improved out of all knowledge during the last four or five years; prior to that period a good silica brick was by way of being a God-send. One of the reasons for the improvement, he suggested, was that at last the makers seemed to be paying attention to the problem of shape; quite a number of makers were producing silica bricks of excellent shape, perfectly square and having sharp corners, so that close-fitting structures could be provided. He believed it was common experience in the steel industry that a well-shaped silica brick, even if made of an inferior material, would give service equal to, if not better, than a brick of superior and possibly more expensive material, but which did not fit so closely.

Setting Cements for Refractories.

The position with regard to setting cements for refractories was most unsatisfactory. Many people tried to economise by using cheap cement. Others used much-advertised cements and obtained almost equally bad results; quite frequently people used a setting cement of very high quality, and which was very refractory, so that after the furnace had been in use for some time the joint between the bricks protruded beyond the eroded or fluxed face of the bricks, and the result was almost as bad as if a cheap cement had been used and the joint had fluxed away. Refractory makers might well consider the supply of a cement which would give a good, tight joint, and which would at the same time flux and erode at exactly the same rate as the body of the brick itself. Too frequently the two did not erode at constant rate.

Founders were also awaiting with great anxiety the production of a really satisfactory basic brick. Numerous attempts had been made to produce one. Magnesite bricks were used almost universally, but they were very expensive, and in many cases they were not satisfactory in use. A good alternative to magnesite was needed.

Finally, he asked for expressions of opinion with regard to cupola linings, and particularly the use of the cement gun; he could foresee all sorts of difficulties arising if the ordinary cupola attendant were provided with a gun which would squirt cement about at several-atmospheres pressure.

Mr. Green said there were on the market cements which would fuse at pretty well the same temperature as the bricks. In the early days the idea was to have cement of a very much lower fusion point than that of the bricks, so that when the heat was applied to the cement it would stick to the bricks. But that was not necessary nowadays, because cold-setting cement, somewhat like Portland cement, could be obtained.

With regard to basic bricks, he said that experiments were being conducted with a view to producing sound dolomite bricks which would not disintegrate, and he believed it was quite possible that those bricks would be on the market some time this year.

Mr. V. C. Faulkner (Past-President of the Institute) expressed surprise that Mr. Green had not laid more stress upon the important property of the conductivity of bricks. If a brick were a bad conductor, he said, its face had to do the whole of the work of resisting temperature, whereas if it could pass a certain amount of heat back its life would be much longer. In the course of experiments he had made in the past, especially with conductive hearths, the refractories had withstood 1,000 heats in a furnace, provided the faces of the refractories were given the minimum amount of work to do—by which he meant that much of the heat was passed back from the faces.

Mr. Faulkner suggested that in the making of monolithic linings for cupolas it might be advantageous to mix with the refractory material a quantity of graphite or similar material. In that way a considerable improvement might be effected.

Mr. Green replied that really first-grade bricks to-day are much more conductive than bricks used previously; they are fired to a much higher temperature than formerly, and, in addition, the manufacturers are now grading bricks, *i.e.*, putting fine-grade grog into them in place of the larger pieces. Vitrification, of course, also helped conductivity. So that it is only the cheaper hand-made bricks that are not so conductive. If one wanted a really good conductive brick one should go to the silicon-carbide class, or something like that, but it was too expensive, of course, for normal use. The mixing of graphite with refractory materials was being done by quite a number of people, he understood.

Vote of Thanks.

Mr. A. W. G. Bagshawe, proposing a vote of thanks, suggested that the reason for the discussion being so short was that his expert knowledge left no room for argument. A matter of great importance, he continued, was that of co-operation between the gas industry and the refractory makers, and he suggested that the foundry industry also, when it endeavoured to standardise bricks for cupolas and furnaces, might co-opt the representatives of the refractory makers. Foundrymen were rather inclined to set their own limits and to tell the makers of refractories that they must meet those limits, even if the latter pointed out that those limits were not the best.

It was true, as Mr. Green had pointed out, that first cost was not the only consideration. At the same time, founders had to bear in mind the prices which the public could afford to pay for the products of the foundry. If the makers of first-class bricks could not bring their prices down to about the prices charged by the makers of the inferior qualities, none of us was likely to achieve that increased production which would make for better conditions all round, and for better trade. The best qualities must be made available at low price, and he urged that makers of refractories would look at the matter from that point of view.

Finally, he assured Mr. Green that the members of the Branch had learned a lot from his Paper, though they did not feel competent to discuss it.

Mr. V. C. Faulkner, seconding the vote of thanks, said that the Institute had in being a Refractories Committee, and it would be a good thing to ask that Committee to think more about specifications for refractory materials other than sands for the foundry industry. Foundrymen had allowed the refractory manufacturers to standardise the sizes of bricks to be used for ladles and so on; whether or not those sizes were the best he did not know, but it had been his experience that when one asked a manufacturer to make refractory bricks which were not standard, one did not get such good quality as in the recognised standard sizes.

The vote of thanks was carried with acclamation.

Mr. Green, responding, said he had tried to emphasise that the manufacturer who was really trying to produce better products was rather in difficulties owing to the operations of the cheap brick makers. If one were trying to make a good clay brick, for example, the clay must mature over very long periods. Practically all fireclays, when won from the earth, were hard, like rocks. Some manufacturers would take those rocks to the mill immediately and break them down, mix them with water and make them into bricks. In that way, however, one did not obtain a reliable and uniform product. The maker of good bricks had to allow the material to mature in the open for probably two years; occasionally he turned it over, to allow the elements of the atmosphere to get to it. It would be appreciated that the maturing and the extra handling it involved would cost a tremendous amount of money, and the maker who was preparing his material in that way could not compete with the maker who was breaking down the material without maturing it. The same consideration applied to other stages in the process of manufacture.

It must also be borne in mind that the demand was always for higher and higher furnace temperatures and quicker heating cycles, so that the manufacturers of refractories were always up against it.

* Foundry Trade Journal, March 23, 1933, p. 208.

The Manufacture and Physical Properties of Nickel-Copper-Chromium Austenitic Cast Irons.

(*Concluded from page* 348.)

Electrical and Magnetic Properties.

"Ni-Resist" is for all practical purposes non-magnetic. It has also a high electrical resistance, coupled with a low-temperature coefficient of resistance.

Magnetic Permeability ..	1.03 to 1.05
Magnetic Remanence	Nil
Specific Electrical Resistance ..	135 to 140 (microhms per cub. cm.)
Temperature Coefficient of Electrical Resistance (0 to 100 deg. C.)	0.00045

Practical Suggestions.

(1) Fully-alloyed iron should be completely non-magnetic and soft enough to machine readily.

(2) A hard or magnetic iron is a sure sign that the alloy content is deficient.

(3) A quick foundry check for a correct alloy content can be made by testing whether or not the cold casting is attracted to an ordinary horse-shoe magnet.

(4) Chips or drillings may become magnetic due to work-hardening in cutting, and are therefore not a reliable check on composition.

(5) A quick drilling test can be made for machinability.

(6) Tumbling may skin-harden certain castings. Sand blasting is preferable.

(7) To soften or anneal a casting, heat to a bright red or yellow heat (950 to 1,000 deg. C.) and cool in air or quench in oil according to the thickness of the casting.

(8) Too much scrap may produce a low-carbon iron (under 2.70 T.C.), which may cause chilled edges on thin or small or cold-poured castings. A hard coke contributes to this condition. Keep the total carbon up for good machining.

(9) Save all foundry scrap; it is worth money. It can be distinguished from ordinary iron because it is tougher, non-magnetic and does not rust as readily.

(10) Regular iron following a "Ni-Resist" cupola melt may pick up as much as 2 per cent. of alloy. Where alloyed iron is regularly made, it can be poured into production castings. Some foundries make a short tap and pig the alloyed "wash-out" as a substitute for pig-iron in new "Ni-Resist" charges, thus reducing the N.C.C. portion of the new charge.

(11) Weld "Ni-Resist" castings with "Ni-Resist" welding rods which can be made as needed.

American Foundrymen's Association.

The following is the tentative schedule of sessions of the 1933 Convention of the American Foundrymen's Association, to be held at the Hotel Stevens, Chicago, on June 19, 20, 21, 22 and 23:—

Monday, June 19.

Committee meetings.

2 p.m.—Conference on electric power costs in the foundry: Steel Founders' Society of America, Gray Iron Institute, and Malleable Iron Research Institute co-operating.

Tuesday, June 20.

Registration. Exhibits open at 9 a.m. (the exhibit will be open from 9 a.m. to 6 p.m. on each day of the Convention).

8.30 a.m.—Shop courses:—(*a*) Sand: Application of Control Method to Continuous and Jobbing Foundries; (*b*) Cast Iron: Small Cupolas and Their Operation.

10 a.m.—Formal opening of Convention. President's address.

10.30 a.m.—Foundry sands:—"Application of Sand Testing by the Producer," by C. M. Hardy, Hougland & Hardy, Evansville, Ind.; "Grain Structure Effect on Mould Permeability Control," by H. W. Dietert and F. Valtier, Detroit, Mich.

12.30 p.m.—Joint A.F.A. and F.E.M.A. luncheon. Speaker, Mr. Fred Sargent, President, Chicago & North-Western R.R.

2 p.m.—Foundry costs. "Building for Profits," a dramatisation of a foundry's experience with cost methods.

Wednesday, June 21.

8.30 a.m.—Shop courses:—(*a*) Sand: Classification; (*b*) Cast iron: Gating terms.

10 a.m.—Cast iron: Melting. "Practical Experiences with Electric Furnace Iron," by C. L. Frear, De Laval Separator Company, Poughkeepsie, N.Y.; "High-Test Iron in the Electric Furnace," by C. R. Culling, Carondelet Foundry Company, St. Louis, Mo.; "Air Furnace Cast Iron," by D. P. Forbes, Gunite Corp., Rockford, Ill.

10 a.m.—Steel founding: Alloys in steel castings. "Molybdenum," by H. W. Gillett and J. L. Gregg, Battelle Memorial Institute, Columbus, Ohio; "Chromium," by J. H. Critchett, Union Carbide & Carbon Company, New York City; "Nickel," by A. G. Zima, International Nickel Company, New York City.

10 a.m.—Non-ferrous metals. "Effects of Small Additions of Aluminium, Silicon and Phosphorus to a Leaded Bronze," by H. J. Roast, McGill University, Montreal, P.Q., Canada; "Bearing Metals," by C. S. Cole, Copper and Brass Research Association, New York City; "Beryllium-Copper Castings," by E. F. Cone, New York City.

10 a.m.—Malleable iron. "Sand Control on a Continuous Moulding System," by Chas. Morrison, Saginaw Malleable Iron Div., General Motors Corp., Saginaw, Mich.; "The Effects of Superheat on the Annealing of Malleable Iron," by A. E. White and R. Schneidewind, University of Michigan, Ann Arbor, Mich.; "High-Strength Wear-Resistant Malleable Iron," by Rebecca Hall, Chicago.

12.30 p.m.—Round-table luncheon conferences:—(*a*) Steel: "Vanadium," by Jerome Strauss, Vanadium Corp. of America, Bridgeville, Pa.; "Coreless Induction Furnace Operation," by W. E. McKibben, General Electric Company, Schenectady, N.Y. (*b*) Malleable iron. Chairman, J. H. Lansing, Danville Malleable Iron Div., Allith Prouty Company, Danville, Ill. (*c*) Non-ferrous founding. Chairman, H. M. St. John, Detroit Lubricator Company, Detroit.

Thursday, June 22.

8.30 a.m.—Shop courses:—(*a*) Sand: Control; (*b*) Cast iron: Structures.

10 a.m.—Steel founding. "Studies on Solidification and Contraction and Their Relation to the Formation of Hot Tears in Steel Castings," by C. W. Briggs and R. A. Gezelius, Naval Research Laboratory, Washington, D.C.; "Dynamic Properties of Steel Castings as Determined by the Impact Test," by Fred Grotts, Continental Roll & Steel Foundry Company, East Chicago, Ind.; "Advantages to Foundrymen of Radiographic Inspection," by C. Isenburger, St. John X-Ray Corporation, New York City.

10 a.m.—Cast iron: "Sea Coal Effect on Sands," by Ben Hird, Institute of British Foundrymen; "Effects of Slag on Cupola Operation and Metal Structure," by R. H. Bancroft and A. C. Meyer, Perfect Circle Company, New Castle, Ind.; "Titanium in Cast Iron," G. F. Comstock, Titanium Alloy Mfg. Company, Niagara Falls, N.Y.; "High-Silicon Heat-Resisting Cast Iron," by A. L. Norbury and H. H. Morgan, British Cast Iron Research Association, Birmingham, England; "Martensitic Quenching of Cast Iron," by M. Delbart, French Foundry Technical. Association.

10 a.m.—Non-ferrous metals—Symposium on deoxidation and degasification of bronze-foundry alloys: Alloy Group 1—Valve bronzes (85-5-5-5 type); Alloy Group 2—Leaded-bearing bronzes (80-10-10 type); Alloy Group 3—Tin bronzes (88-11 type).

2 p.m.—Business meeting.

2.30 p.m.—Foundry housekeeping—Joint meeting of A.F.A., National Safety Council and National Founders' Association.

Friday, June 23.

8.30 a.m.—Shop courses: (*a*) Sand control; (*b*) Alloy cast iron.

10 a.m.—Cast-iron tests and specifications—Joint meeting with A.S.T.M.: (*a*) Introduction and (*b*) "Significance of Testing Cast Iron and Limitations of Testing," by H. Bornstein, chairman A.S.T.M. Committee A-3 and A.F.A. Cast Iron Division, chief chemist, Deere & Company, Moline, Ill.; (*c*) "Correlation of Test-Bar and Casting," and (*d*) "Transverse and Tensile Tests, Modulus of Elasticity, Fatigue and Impact Tests," by R. S. MacPherran, Allis Chalmers Mfg. Company, Milwaukee, Wis.; (*e*) "A.S.T.M. Specification A48-32T," by J. W. Bolton, Lunkenheimer Company, Cincinnati, Ohio; (*f*) "Mechanism of Testing," and (*g*) "Factors in Production of Test-Bars," by J. T. MacKenzie, American Cast Iron Pipe Company, Birmingham, Ala.; (*h*) "Value of Hardness Testing for Control of Product," and (i) "Wear and Machinability Tests," by A. L. Boegehold, General Motors Corporation Research Laboratory, Detroit.

10 a.m.—Materials handling—Joint meeting with Materials Handling Division of American Society of Mechanical Engineers: "The Field of Materials Handling in Small Foundries," by Max Amos, Standard Automotive Parts Company, Muskegon, Mich.; "The Field of Materials Handling in Semi-Production Foundries," by W. L. Seelbach, Forest City Foundries Company, Cleveland.

12.30 p.m.—Conference on apprentice training.

2 p.m.—Conference on foundry education in engineering schools.

During the following week—Engineering Week of the Century of Progress—the A.F.A. will co-operate in two joint meetings as follows:—

Monday morning, June 26.

Symposium on cast iron—American Society for Testing Materials, Hotel Stevens.

Tuesday morning, June 27.

Foundry practice—American Society of Mechanical Engineers: "Engineering Cast Irons," by O. Smalley and W. W. Kerlin, Gray Iron Institute, Cleveland; "Electric Furnace Cast Iron," by H. H. Walther, Dayton Steel Foundry Company, Dayton, Ohio.

Tin Uncertainties.

By "ONLOOKER."

At the time of writing the price of tin has been bid up above £180, mainly on speculative buying in the London market, assisted by heavy purchases made by consumers in New York, who have hastened to cover their forward requirement in expectation of higher commodity prices as a result of the Government's inflationary programme. Stocks on the other side of the Atlantic are said to be down to a dangerously low level and users have been active to secure supplies for immediate use.

Unlike copper, in which the price trend is mainly dictated from New York, tin values originate in London and the East, these two markets acting and reacting on each other, while America follows the lead thus given. With the upward rush of values on abandoning gold, the quotation for tin in the States took a definite lead on its own initiative, and in one day the price was advanced by a full cent per pound, equal to approximately £6 per ton. This is a new aspect of price movements in the tin market, and shows to what an extent the upheaval caused by America's change of currency policy reacted on prices in that country. As the world's largest individual user of tin it is perhaps only right and reasonable that America should at times take a lead in this manner, but it is unusual, and on the present occasion it was the cause of contradictory movements in the sterling price, which, with the £ appreciating in value against the dollar, one would have expected to see lower.

As far as the London market is concerned, pool buying has not of late been so much in evidence, and it has been possible to allow the market to a greater degree than usual to look after itself. Recent statistical returns have encouraged the belief that the position is improving, for the heavy stocks lying in this country have been drawn upon and weekly reductions have taken place. At the end of April the total visible supplies, at 49,660 tons, showed a reduction of 1,800 tons on the previous month and of nearly 11,000 tons on the position at the same date last year, a good proportion of this fall being in a shrinkage in the tonnage of metal afloat and in stock in this country. Incidentally tin is priced to-day at some £70 higher than a year ago, but consumption is not yet 50 per cent. better!

That the rate of use has improved cannot, however, be denied, and during the past few months this has been particularly noticeable in the United States, while it is, of course, well known that the tinplate works in South Wales are much better employed than they were. When all has been said for tin, however, that can be, the fact remains that the present improved statistical position and a consequently higher price are the result of artificial manipulation, as illustrated by the scheme for reducing output and limiting shipments. Part of the original plan of pool holdings was that a beginning in unloading this reserve should be made at £150, but revisions in this principle have brought the figure up to £165, and that point has now been passed. Rather unexpectedly, no serious reactionary tendency in values has been seen above £160, but for all that the market is in a somewhat nervous frame of mind, and although the exciting events of the past few weeks have imparted an appearance of strength, these are factors which must not be overlooked.

In comparison with other members of the non-ferrous group, tin is undoubtedly standing at a high price, and is in consequence more vulnerable to any attack by the "bear" faction. At a time like the present, when the outlook is uncertain in the extreme and almost anything can happen, a cautious view of the immediate future of this metal is certainly indicated, and he who speculates does so at his peril!

This Week's News in Brief.

Trade Talk.

The Greenock Dockyard Company, Limited, Greenock, have contracted to overhaul and recondition four large steamers at Garvel Docks, Greenock.

Shotts Foundry Band opened the season on Sunday afternoon, when Bandmaster Gossage was in charge. The band has been entered for the Scottish Amateur Band Championship on May 27.

Messrs. C. A. Parsons & Company, Limited, Heaton, Newcastle-upon-Tyne, have received an order for a turbo-generator of 4,000-kw. capacity, complete with alternator and condensing plant, for Lucknow.

Two coasting steamers, the "Cheviot" and the "Causeway," have arrived in the Clyde from Belfast to be broken up at the shipbreaking yard of Messrs. Lithgows, Limited, Port Glasgow. The former was built at Newcastle in 1891 and the latter at Troon in 1894.

The report of the Glasgow District Committee of the Amalgamated Engineering Union shows a slight improvement in the number of members in work. For the third successive month there has been a reduction of approximately 200 in the number of unemployed engineers signing the union's books.

Mr. H. Harrod, foundry manager, had the honour of being presented to H.R.H. Prince George during his visit to the Lancashire Steel Corporation's works at Irlam on Tuesday, May 9. The presentation was made by Mr. J. E. James, chairman of directors of the Lancashire Steel Corporation, Limited, and Mr. J. Sinclair Kerr, managing director.

On the tower of the St. Antoine market at Montreal is a large clock with an overall diameter of 12 ft. 6 in., made by Blick Time Recorders of Canada, Limited. The dial is made up of a lattice work of polished cast aluminium alloy (5 per cent. silicon) with frosted glass inserts, while the outer rim is of the same alloy black-enamelled.

Sir Harold Yarrow and Lady Yarrow attended the launch of the Portuguese destroyer "Tejo" at Lisbon this week. The "Tejo" is one of five destroyers ordered by the Portuguese Government from Messrs. Yarrow & Company, Limited, Scotstoun, Glasgow. Two of the vessels are being built in Glasgow and three in Lisbon, and the machinery for all five is being built in Glasgow.

The directors of the Coltness Iron Company, Limited, have arrived at the conclusion that the capital of the company is in excess of its requirements, and have decided to reduce the paid-up capital by returning 5s. per share to the holders of ordinary shares, making these shares of the nominal value of £1 each, with 15s. per share paid, subject to the approval of the shareholders and the sanction of the Court.

Messrs. Weatherhead, of Cockenzie, have just delivered to Mr. Andrew M'Crindle, Girvan, the new fishing boat "Aliped V." This is the fifth of the type to be built for the same owner, and is fitted with Kelvin crude-oil engines, and has a carrying capacity of 700 baskets. Messrs. Weatherhead have other orders in hand for Girvan owners, and delivery is to be given in time for the herring summer season.

We are informed by Messrs. Edward G. Herbert, Limited, of Atlas Works, Chapel Street, Levenshulme, Manchester, that after 20 years' experience as sole British agents for the Tinius Olsen Testing Machine Company, during which period they have sold hundreds of Olsen Testing Machines, they have now concluded a licence arrangement to build any of their well-known testing machines throughout at their Levenshulme works, so that they can now offer all-British-built testing machines to the well-known Olsen designs.

Messrs. G. & J. Weir, Limited, Glasgow, have just completed what is probably the lightest flying machine in the world, a 500-lb. autogiro. The machine, a single-seater, has been designed and built under the supervision of Air Commodore James G. Weir, who is chairman of the Cierva Autogiro Company, of London. Preliminary tests indicate that the machine will be a success. The cost of the machine is only £250, and if success attends this first experiment, it is probable that a series of similar machines will be built in Glasgow.

A large and representative company of buyers from all parts of the country attended sales of machinery in Bridgeton, Glasgow, this week, when motor engineering plant, machinery and equipment of the Argyll Motor Company, Limited, in voluntary liquidation, was offered for sale. At the same time, a quantity of machinery was offered on behalf of Messrs. Acme Wringers, Limited, who are reorganising and introducing new improved machinery into their factory. They now largely use sheet metal instead of castings. There was strong competition, and good prices were realised for many lots of machines.

The Glasgow District Committee of the National Union of Foundry Workers has asked the National Executive to place before the British Trades Union Congress a demand that the General Council be instructed to take a ballot vote of all affiliated unions upon the question of establishing a 40-hr. working week, with no reduction in wages and the abolition of all overtime. If the demand be not conceded, then the General Council is asked to take steps to prepare for a general strike. Glasgow District Committee has asked all unions in the West of Scotland to take similar action, pointing out that the shorter working week would diminish unemployment.

The suggestions of Mr. Donald MacNicoll, managing director of Messrs. Cockburns, Limited, Cardonald, Glasgow, regarding the design of steam safety valves, have been approved by the Board of Trade, and will be adopted in the greater portion of the world's merchant ships. The new rules and formulæ will be applied to all steamers classified by Lloyd's Register, the British Corporation, and Bureau Veritas. The idea was first embodied in a Paper Mr. MacNicoll read to the Institute of Marine Engineers in 1931, and the whole question was later examined by a special consultative committee of engineers and shipbuilders, and it was as a result of their report that the Board of Trade accepted in essentials Mr. MacNicoll's suggestions.

Glasgow Corporation have acquired two new fire engines, which, with the exception of the tyres, are entirely Clyde products. The chassis have been made by Messrs. Halley Motors, Limited, Yoker, and the pumps by Messrs. Drysdale & Company, Limited, Bon Accord Works, Yoker. The chassis are of a low-slung design, embodying the latest features of fire-fighting apparatus. The pumps are of special large-capacity turbine type and guaranteed to draw 500 to 700 galls. of water per min. and capable under favourable conditions of throwing 900 to 1,000 galls. per min. The engines have just completed tests at Rothesay dock, where the lifting capacity was demonstrated. A number of tests of deliveries under various conditions were later made on the Forth and Clyde Canal, with satisfactory results.

Contracts Open.

Ampthill, May 23.—Supply and laying of 900 yds. of 2-in. cast-iron pipes, for the Urban District Council. The Surveyor to the Council, 8, Dunstable Street, Ampthill. (Fee £1 1s., returnable.)

Douglas, I. of M., June 1.—1,400 tons of cast-iron pipes, etc., for the Corporation. Mr. T. C. Greenfield, water engineer, Town Hall, Douglas, Isle of Man. (Fee £3 3s., returnable.)

Milton-under-Wychwood, May 22.—Supply and laying of 2,126 yds. of 4-in. cast-iron pipes, 746 yds. of 3-in. cast-iron pipes, valves, etc., for the Chipping Norton Rural District Council. Mr. S. P. Bendle, 10, Enstone Road, Charlbury, Oxon. (Fee £2 2s., returnable.)

Company Reports.

Tweedales & Smalley (1920), Limited.—Net profit, £32,121; final dividend of 3½ per cent., making 6 per cent. for the year.

Guest, Keen & Nettlefolds, Limited.—After charging debenture interest amounting to £70,415 and making provision out of profits for redemption of debenture stock amounting to £32,704, profits of the year ended March 31, subject to completion of audit, are approximately £130,000. The directors recommend a final dividend on the first preference shares at the rate of 5 per cent. per annum for the six months ended March 31, free of tax.

Personal.

Sir William J. Larke, K.B.E., is to address the Leicester Rotary Club on Monday.

Mr. William Urquhart, of Kildary, Ross-shire, who is probably the oldest working blacksmith in Britain, celebrated his 90th birthday on May 10. He went to his work as usual in the smithy.

Mr. H. S. Simpson, President of the National Engineering Company, Chicago, President of the Foundry Equipment Manufacturers' Association and Past-Director of the American Foundrymen's Association, is visiting England this summer.

Mr. John J. Sheehan, A.R.C.Sc.I., has been appointed to the position of assistant foundry superintendent at the Austin Motor Company's Longbridge Works, Birmingham. Previously he was employed at the Ford Motor Company's Works at Cork and at Dagenham. Mr. Sheehan has specialised in sand control and synthetic sands, as well as the economic production of high test cast irons for the automobile industry, and hopes to have ample scope in this direction in his present appointment.

Mr. A. Glynne Lobley, general manager of Birmingham Electric Furnaces, Limited, is shortly to visit the Electric Furnace Company, of Salem, Messrs. C. I. Hayes, Inc., and other firms in America for the purpose of augmenting, by discussion and inspection, the excellent results of agreements whereby an exchange of patents and designs is effected. He will spend a month in America, visiting important modern electric-furnace installations and investigating the latest research developments during his stay.

Will.

Stephen, Frederick John, M.A., M.I.N.A., J.P., chairman of Messrs. Alexander Stephen & Sons, Limited, Linthouse, Glasgow £174,341

Obituary.

Mr. Robert Fraser, who was employed at the Torry Foundry, Aberdeen, while placing a corrugated sheet on the foundry roof, fell through a gap to the foundry floor and sustained fatal injuries to his head and face.

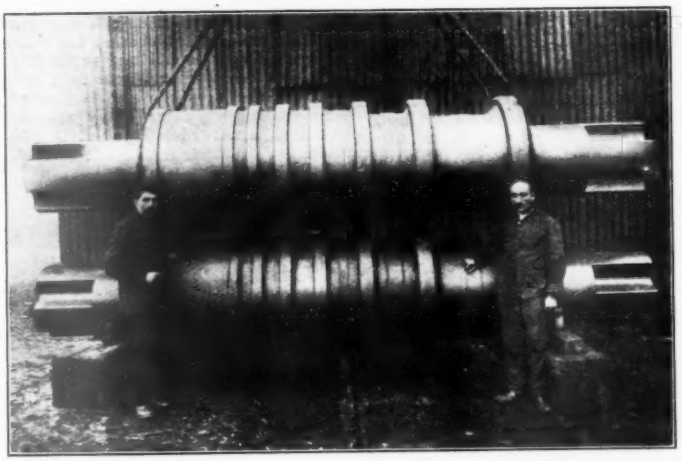
Mr. John Cormack Robertson died at Chesnut Road, Plumstead, on May 6. Mr. Robertson, who was 72 years of age, served his apprenticeship with Messrs. J. Abernethy & Company, Limited, Aberdeen, in whose service he remained for a number of years. He was for nearly 40 years in the naval transport, from which he retired six years ago.

The death occurred on May 6, at his home in Jordanhill, Glasgow, of Mr. Archibald Waddell, the chief shipbuilding estimator of the Fairfield Shipbuilding & Engineering Company, Limited, Govan. Mr. Waddell, who was 66 years of age, had been connected with the firm all his working life. Beginning in the drawing office, where he served his apprenticeship, he eventually became chief of the estimating department, a position which involved the preparation of estimates for vessels of widely different classes, including passenger liners and warships.

We sincerely regret to announce the death of Mr. William Shaw, of Messrs. W. Shaw & Company, Limited, Wellington Cast Steel Foundry, Middlesbrough. This business, which was established by Mr. Shaw's father, is one of the largest steel foundries on the North-East Coast. Mr. Shaw joined the Institute of British Foundrymen in 1929, and in the following year was elected President of the Middlesbrough Branch, as the special demands of the annual Convention held in the town that year under the presidency of Mr. F. P. Wilson, J.P., called for a leader with just such a personality as Mr. Shaw possessed. His work in that connection was sincerely appreciated both by his local colleagues and the visitors. Mr. Shaw was very prominent locally as a sportsman, a freemason, a church worker and a politician, and held high offices in all these activities. Mr. Shaw leaves a widow, six sons and a daughter, and to them we express on behalf of the foundry industry our sincerest sympathy.

At a meeting of the Institution of Welding Engineers at Newcastle-upon-Tyne, Mr. A. E. Shorter presiding, it was agreed to form a North-East Coast Branch of the Institution.

XUM

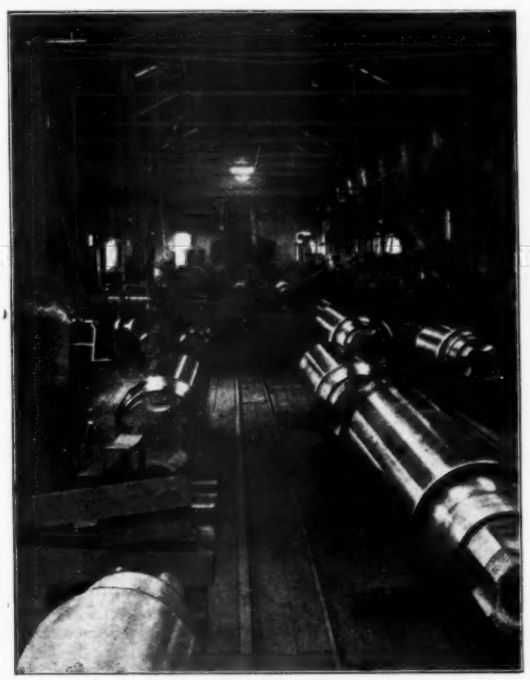


45 TONS.

Customers' Photographs

SPECIAL

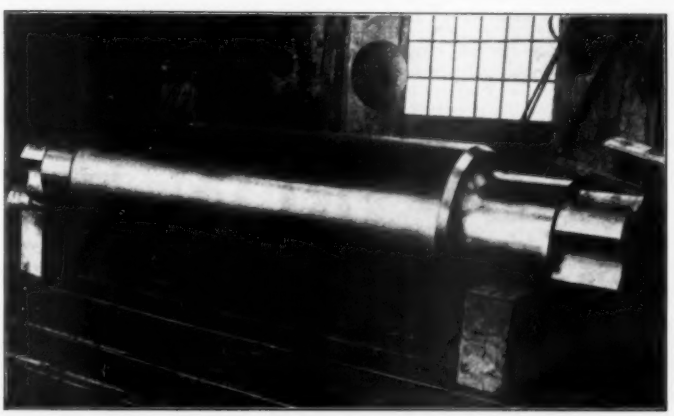
FRODAIR



PIGIRON

Best after test

20-TON ROLL.



50 YEARS

FRODAIR IRON & STEEL Co. Ltd.
FENCHURCH HOUSE, LONDON.

Raw Material Markets.

There are indications of improving business in the iron and steel markets, although activity in several branches of the consuming industries remains limited. The output of raw material is well maintained. In the pig-iron section, a fair demand has been experienced, and in one or two cases the furnaces have been able to reduce their stocks of unsold iron. Unfortunately, however, the pig-iron demand continues to be affected by the depression in the scrap market, where exceptionally low prices have been accepted.

Pig-Iron.

MIDDLESBROUGH.—More interest is being taken in this market by home consumers. A good number of prompt sales is being transacted, whilst expiring contracts are being renewed at the new rates. Export business has shown a slight improvement, particularly in the Italian market, whilst Scandinavian prospects are regarded as much brighter since the negotiation of the trade agreements. In connection with the latter, it is reported from Copenhagen that the Danish Government has reverted to the system of pig-iron import licences. It is thought that a similar system may be under consideration in Sweden. Regular deliveries of Cleveland iron are being sent to Scotland. Quotations for new business remain at 62s. 9d. per ton for No. 3 Cleveland G.M.B., delivered Glasgow, which compares with 62s. 6d. delivered Middlesbrough and 64s. 6d. delivered North-East Coast. No. 1 Cleveland foundry iron is quoted at 2s. 6d. per ton more than the foregoing figures, and No. 4 foundry and No. 4 forge at 1s. less.

As regards East Coast hematite, the position has been strengthened by the transference of a blast furnace from hematite to ferro-silicon. The demand is now equal to, if not slightly more than, the current output. There are, however, very large stocks still in the possession of the producers. The latter continue to quote 59s. per ton for East Coast mixed numbers, although there can be very little profit at this level. The merchants are no longer under-selling. No. 1 quality is at 6d. per ton premium.

LANCASHIRE.—Slightly better business was experienced on the Lancashire markets during the past week. While prompt and monthly buying still constitutes the bulk of the business, there has been a welcome leavening of long-period contracts. Deliveries into consumption in this area have at least been maintained at recent rates. For delivery to users in the Manchester price zone, Derbyshire and Staffordshire No. 3 are quoted on the basis of 67s. per ton, with North-East Coast iron at about the same figure, Northamptonshire at 65s. 6d., Derbyshire forge at 62s., and East and West Coast hematite iron at 75s. 6d. and 80s. 6d. respectively. Although Scottish iron is only in limited demand in this area, the makers maintain their prices at about 82s. per ton, including delivery equal to Manchester.

MIDLANDS.—There seems to be a slightly quicker demand for pig-iron in this area, believed to be due to increased activity in the light-castings trade. Current consumption is reported to be at the highest level experienced so far this year. Some of the special grades of iron have been selling well in this district. No alteration in prices has taken place, the figures being 62s. 6d. for No. 3 Northants and 66s. for North Staffordshire, Derbyshire and Lincolnshire No. 3, including delivery to Birmingham and Black Country stations. Cleveland No. 3 is also available at 66s. Any forge for foundries is at 4s. per ton below No. 3. Scottish No. 3 is offered at between 83s. and 85s. delivered Birmingham district, and other irons of similar analysis range from 70s. to 80s. Foundry hematite prices are very firm, there having been a fair amount of buying for forward delivery during the last few weeks. West Coast No. 3 or mixed numbers is controlled at 84s. 6d. per ton delivered this district, with Welsh and East Coast hematite at between 74s. 6d. and 77s. 6d.

SCOTLAND.—That the pig-iron demand in this area shows little or no sign of recovery from its recent low levels is generally admitted on the markets. The output of the seven furnaces now blowing is more than sufficient for current needs, and several of the furnaces may be closed down as soon as the makers' stocks have been replenished. The present rate of activity at the light-castings foundries leaves much room for improvement, although one or two individual firms are more fortunately situated. There is no alteration to report in prices, the official minimum of 65s. for No. 3 foundry f.o.t. furnaces still remaining in force, with 2s. 6d. additional for No. 1. Middlesbrough iron is unchanged at 59s. 9d. at Falkirk and 62s. 9d. at Glasgow for No. 3 Cleveland, with No. 4 foundry 1s. less. Other English foundry irons are quoted at a discount of 2s. 3d. per ton on these figures.

Coke.

There are no new developments to report in the foundry-coke market. Forward buying is almost entirely absent, consumers being apparently satisfied that there is no immediate prospect of any rise in prices. Best Durham foundry grades vary in price from 36s. 6d. to 38s. per ton, with second quality at about 2s. 6d. per ton less. Quotations for Welsh cokes range, according to analysis, from 30s. to 46s. per ton, delivered Birmingham and district.

Steel.

Business continues to expand slowly, the improvement being chiefly noticeable in the British home market, says the official report of the London Iron and Steel Exchange. The export trade is still suffering from such adverse influences as the political complications in Europe; the uncertainties of the American position; and the new policy of the European Steel Cartel. In the home trade, however, the shipbuilding and engineering industries are busier than they have been for some time, and the absence of Continental competition in the British market is diverting an increasing volume of orders to the British steelworks. In the semi-finished steel department, business has not developed to the extent expected. For the most part, consumers continue to buy in comparatively small quantities; but the advance in the prices of Continental steel and the decrease in the stocks held by consumers are gradually creating an increased demand for British material. The export demand for most descriptions of finished steel is rather quiet; but in the home market business has been brighter of late.

Scrap.

There has been a glut of supplies in the Cleveland cast-iron scrap market, but the position is now somewhat stronger, and ordinary metal is quoted at 37s. 6d. per ton and machinery at about 40s. per ton. Light castings are nominally priced at 34s. There is still a steady demand for cast-iron scrap in the Midlands, where heavy machinery metal is offered at 47s. 6d. and good heavy at about 45s., delivered works. Clean light metal is now realising about 40s. In the Scottish market the demand is poor, and it is difficult to sell best machinery cast at 50s. to 51s. 3d. and ordinary cast at 45s. The scrap-iron market in South Wales is also suffering from over-abundant supplies, heavy cast iron in large pieces and furnace sizes being at 43s. 6d., machinery at 48s. to 50s. and light cast at 37s. 6d.

Metals.

Copper.—Market sentiment is considerably stronger, assisted by reports of a proposal to form a copper development association, to increase the consumption of the metal, and by the news that certain American producers are further curtailing their outputs. The opinion is also repeated from many quarters that the price of this metal is low in relation to world levels, and that higher prices may be expected when a more normal level of world consumption is returned to. In view of these factors, market quotations have been very strong, although the interest has been mainly speculative. Buying by industrial users has been somewhat ragged.

The week's prices have been as follow :—

Cash.—Thursday, £33 16s. 3d. to £33 17s. 6d.; Friday, £34 8s. 9d. to £34 10s.; Monday, £34 6s. 3d. to £34 8s. 9d.; Tuesday, £33 16s. 3d. to £33 17s. 6d.; Wednesday, £35 1s. 3d. to £35 2s. 6d.

Three Months.—Thursday, £34 to £34 1s. 3d.; Friday, £34 13s. 9d. to £34 15s.; Monday, £34 10s. to £34 12s. 6d.; Tuesday, £34 to £34 1s. 3d.; Wednesday, £35 6s. 3d. to £35 7s. 6d.

Tin.—Borne up on a wave of speculative activity, this metal has touched very high levels, but there are signs that the crest has been reached. Following the reaction on Wall Street over last week-end, tin prices had a considerable set-back on the Monday, but later recovered. The tinplate industry in this country continues to absorb a large amount of metal, but it has lately been experiencing keener competition from United States producers, in the South American markets particularly, owing to the fall in the dollar.

Daily quotations :—

Cash.—Thursday, £185 12s. 6d. to £185 15s.; Friday, £187 12s. 6d. to £187 15s.; Monday, £183 7s. 6d. to £183 10s.; Tuesday, £184 to £184 5s.; Wednesday, £187 5s. to £187 10s.

Three Months.—Thursday, £186 to £186 5s.; Friday, £188 5s. to £188 7s. 6d.; Monday, £184 to £184 5s.; Tuesday, £184 2s. 6d. to £184 5s.; Wednesday, £187 12s. 6d. to £187 17s. 6d.

Spelter.—Prices in this market are fairly firm at the moment, as the European demand is showing a gradual, if slight, improvement. There are reports of long-term contracts being made by consumers, in order to secure themselves against a rise in quotations. In contrast to the position on this side of the Atlantic, the American situation continues to deteriorate. Although deliveries of spelter have improved, the total stocks continue to increase.

Price fluctuations :—

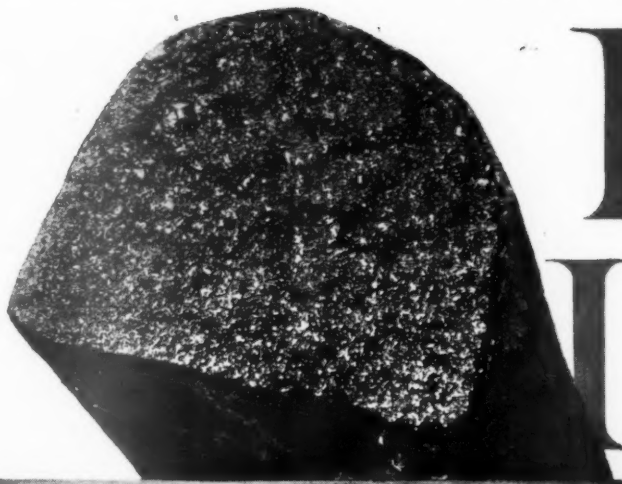
Ordinary.—Thursday, £15 6s. 3d.; Friday, £15 10s.; Monday, £15 8s. 9d.; Tuesday, £15 8s. 9d.; Wednesday, £15 13s. 9d.

Lead.—There is a fairly good demand for lead in this country. Following on seasonal activity in the building industry, there has been increased consumption of pipes and sheets. Cablemakers have not been buying very much lately. The market in America is fairly strong, following on an increased demand.

Daily market prices :—

Soft Foreign (Prompt).—Thursday, £12 1s. 3d.; Friday, £12 8s. 9d.; Monday, £12 8s. 9d.; Tuesday, £12 3s. 9d.; Wednesday, £12 5s.

CAST IRON FLANGED PIPES
2 in.–12 in. & CONNECTIONS. to 24 in. dia.
WE HAVE FIFTY-TWO YEARS OF ACCUMULATED EXPERIENCE AND METAL PATTERNS.
JAMES & RONALD RITCHIE, LTD.,
Telephone: 3852 (2 Lines). MIDDLESBROUGH. Telegrams: "Ritchie, Middlesbrough."



PIG IRON

Manufacturers of FOUNDRY, BASIC and HEMATITE qualities. Delivery from stock.
Booklet giving analyses, etc., will be sent on request.
DORMAN LONG & CO. LTD., MIDDLESBROUGH

DORMAN LONG

GOSSELL & SON, LTD.

110, CANNON STREET, LONDON, E.C.4.

Telephone No.:—MANSION HOUSE 6754. Telegraphic Address:—"GOSSOTTO, LONDON."

Specialities—

PULVERIZED FUEL INSTALLATIONS for METALLURGICAL FURNACES OF ALL TYPES.

FURNACES, MILLS, BUNKERS, FEEDING APPARATUS, BURNERS, Etc., Etc.
DESIGNS SUPPLIED FOR CONVERSION OF EXISTING FURNACES or for NEW INSTALLATIONS.
OVER 400 FURNACES in SUCCESSFUL OPERATION. TRANSPORT OF PULVERIZED FUEL BY ROAD OR RAIL.

BRIDGEWORK, CONSTRUCTIONAL IRONWORK and LOCOMOTIVES, SPECIAL STEEL CASTINGS, ROLLING STOCK.

TUBES AND FITTINGS

Telephone: 52 WEDNESBURY. TRADE MARK Telephone: BRUNSWICK, WEDNESBURY.

On ADMIRALTY and WAR OFFICE LISTS.

BRUNSWICK TUBE WORKS,

EDWARD SMITH, LTD.

WROT IRON TUBES *for* GAS, STEAM, AIR *and* WATER.

WEDNESBURY.

BOILER, WELL & HYDRAULIC TUBES.

LAP-WELDED IRON *and* STEEL TUBES *for* ALL PURPOSES.

WEEKLY PRICE CURRENT.

COPPER.

	£	s.	d.
Standard cash	35	1	3
Three months	35	6	3
Electrolytic	39	10	0
Tough	37	0	0
Best selected	37	10	0
Sheets	65	0	0
India	48	15	0
Wire bars	39	15	0
Do., June	39	12	6
Do., July	39	10	0
Ingot bars	39	15	0
H.C. wire rods	41	10	0
Off. av. cash, April	29	12	5¼
Do., 3 mths., April	29	16	6¾
Do., Sttlmnt., April	29	12	9¼
Do., Electro, April	33	19	4½
Do., B.S., April	32	14	4½
Do., wire bars, April	34	5	1⅝
Solid drawn tubes			10d.
Brazed tubes			10d.
Wire			7d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	8d.
Rods, extd. or rlld.	4¾d.
Sheets to 10 w.g.	8d.
Wire	7⅝d.
Rolled metal	7½d.
Yellow metal rods	4¼d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5¼d.

TIN.

	£	s.	d.
Standard cash	187	5	0
Three months	187	12	6
English	188	10	0
Bars	190	0	0
Straits	204	0	0
Australian	197	0	0
Eastern	201	0	0
Banca (nom.)	198	0	0
Off. av. cash, April	158	0	4⅛
Do., 3 mths., April	158	15	1⅝
Do., Sttlmt., April	158	0	3⅛

SPELTER.

	£	s.	d.
Ordinary	15	13	9
Remelted	15	10	0
Hard	13	5	0
Electro 99.9	17	15	0
English	16	5	0
India	15	0	0
Zinc dust	19	0	0
Zinc ashes	2	5	0
Off. aver., April	15	1	7⅛
Aver. spot, April	14	19	0⅛

LEAD.

	£	s.	d.
Soft foreign ppt.	12	5	0
Empire	12	10	0
English	13	10	0
Off. average, April	10	19	11⅛
Average spot, April	10	17	5⅛

ZINC SHEETS, &c.

	£	s.	d.
Zinc sheets, English	24	0	0
Do., V.M. ex-whse.	23	5	0
Rods	27	0	0
Boiler plates	—		
Battery plates	—		

ANTIMONY.

	£	s.	d.	£	s.	d.
English	37	10	0 to	42	10	0
Chinese				26	15	0
Crude				—		

QUICKSILVER.

	£	s.	d.	£	s.	d.
Quicksilver	8	0	0 to	9	5	0

FERRO-ALLOYS AND STEEL-MAKING METALS.

	£	s.	d.
Ferro silicon—			
25%	7	15	0
45/50%	13	17	6
75%	19	12	6
Ferro-vanadium—			
35/50%	12/8 lb. Va.		
Ferro-molybdenum—			
70/75% carbon-free	6/3 per lb.		
of Mo.			
Ferro-titanium—			
23/25% carbon-free	10d. lb.		
Ferro-phosphorus, 20/25%	£17	17	6
Ferro-tungsten—			
80/85%	1/6 lb.		
Tungsten metal powder—			
98/99%	1/9 lb.		
Ferro-chrome—			
2/4% car.	£29	5	0
4/6% car.	£22	15	0
6/8% car.	£21	15	0
8/10% car.	£21	0	0
Ferro-chrome—			
Max. 2% car.	£33	10	0
Max. 1% car.	£36	5	0
Max. 0.70% car.	£40	2	6
70% carbon-free	11d. lb.		
Nickel—99.5/100%	£225 to £230		
"F" nickel shot	£202	10	0
Ferro-cobalt	5/9 lb.		
Aluminium 98/99%	£100	0	0
Metallic chromium—			
96/98%	2/8 lb.		
Ferro-manganese (net)—			
76/80% loose	£10 15 0 to £11	5	0
76/80% packed	£11 15 0 to £12	5	0
76/80% export	(nom.) £9	15	0
Metallic manganese—			
94/96% carbon-free	1/4 lb.		

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten 2s. 0d.
Finished bars, 18% tungsten 2s. 9d.
Per lb. net, d/d buyers' works.

Extras—
Rounds and squares, 3 in. and over 4d. lb.
Rounds and squares, under ½ in. to ¼ in. 3d. lb.
Do., under ¼ in. to ⅛ in. 1/– lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in. 3d. lb.
Do., under ¼ in. × ¼ in. 1/– lb.
Bevels of approved sizes and sections 6d. lb.
Bars cut to length, 10% extra.

SCRAP.

South Wales—	£	s.	d.	£	s.	d.
Heavy steel	2	4	0 to	2	5	0
Bundled steel and shrngs.	1	17	6 to	2	1	6
Mixed iron and steel	2	0	0 to	2	1	6
Heavy cast iron				2	3	6
Good machinery	2	8	0 to	2	10	0
Cleveland—						
Heavy steel				1	17	6
Steel turnings				1	11	6
Cast-iron borings				1	2	0
Heavy forge				2	10	0
W.I. piling scrap				2	2	6
Cast-iron scrap	1	17	6 to	2	0	0
Midlands—						
Light cast-iron scrap				1	18	6
Heavy wrought iron				2	5	0
Steel turnings, f.o.r.	1	4	0 to	1	5	0
Scotland—						
Heavy steel				1	17	6
Ordinary cast iron				2	5	0
Engineers' turnings				1	12	6
Cast-iron borings				1	11	3
Wrought-iron piling	2	0	0 to	2	1	3
Heavy machinery	2	10	0 to	2	11	3

London—Merchants' buying prices, delivered yard.

	£	s.	d.
Copper (clean)	26	0	0
Brass	17	0	0
Lead (less usual draft)	11	0	0
Tea lead	9	10	0
Zinc	10	0	0
New aluminium cuttings	74	0	0
Braziery copper	22	0	0
Gunmetal	21	0	0
Hollow pewter	115	0	0
Shaped black pewter	85	0	0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast (d/d Tees-side area)—	
Foundry No. 1	65/–
Foundry No. 3	62/6
,, at Falkirk	59/9
,, at Glasgow	62/9
Foundry No. 4	61/6
Forge No. 4	61/6
Hematite No. 1, f.o.t.	59/6
Hematite M/Nos., f.o.t.	59/–
N.W. Coast—	
Hem. M/Nos. d/d Glas.	68/6
,, d/d Birm.	84/6
Malleable iron d/d Birm.	115/–
Midlands (d/d Birmingham dist.)—	
Staffs No. 4 forge	62/–
,, No. 3 fdry.	66/–
Northants forge	58/6
,, fdry. No. 3	62/6
,, fdry. No. 1	65/6
Derbyshire forge	62/–
,, fdry. No. 3	66/–
,, fdry. No. 1	69/–
Scotland—	
Foundry No. 1	67/6
,, No. 3	65/–
Hem. M/Nos. d/d	66/–
Sheffield (d/d district)—	
Derby forge	59/6
,, fdry. No. 3	63/6
Lincs forge	59/6
,, fdry. No. 3	63/6
E.C. hematite	73/6
W.C. hematite	83/6
Lancashire (d/d eq. Man.)—	
Derby fdry. No. 3	67/–
Staffs fdry. No. 3	67/–
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/–
Dalzell, No. 3 (special)	102/6 to 105/–
Glengarnock, No. 3	82/–
Clyde, No. 3	82/–
Monkland, No. 3	82/–
Summerlee, No. 3	82/–
Eglinton, No. 3	82/–
Gartsherrie, No. 3	82/–
Shotts, No. 3	82/–

FINISHED IRON AND STEEL.

Usual district deliveries for iron; delivered consumer's station for steel.

Iron—	£	s.	d.	£	s.	d.
Bars (cr.)	9	0	0 to	9	15	0
Nut and bolt iron	6	15	0 to	7	10	0
Hoops	10	10	0 to	12	0	0
Marked bars (Staffs) f.o.t.				12	0	0
Gas strip	10	10	0 to	12	0	0
Bolts and nuts, ¾ in. × 4 in.	12	17	6			
Steel—						
Plates, ship, etc.	8	15	0 to	8	17	6
Boiler plts.				8	5	0
Chequer plts.				10	7	6
Angles				8	7	6
Tees				9	7	6
Joists				8	15	0
Rounds and squares, 3 in. to 5½ in.				9	7	6
Rounds under 3 in. to ⅜ in. (Untested)			6 15	0	& up.	
Flats—8 in. wide and over				8	12	6
,, under 8 in. and over 5 in.				8	17	6
Rails, heavy	8	5	0 to	8	10	0
Fishplates				12	0	0
Hoops (Staffs)	9	10	0	& up.		
Black sheets, 24g. (10-t. lots)				9	10	0
Galv. cor. shts. ,,				11	15	0
Galv. flat shts. ,,				12	5	0
Galv. fencing wire, 8g. plain				14	0	0
Billets, soft	5	0	0 to	5	7	6
Billets, hard	6	12	6 to	7	2	6
Sheet bars	4	15	0 to	5	2	6
Tin bars				4	15	0

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	11d.
Sheet to 10 w.g.	12d.
Wire	12d.
Rods	11d.
Tubes	15½d.
Castings	13d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
to 10g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	14.34
No. 2 foundry, Valley	14.50
No. 2 foundry, Birm.	12.00
Basic	15.89
Bessemer	16.89
Malleable	16.39
Grey forge	16.39
Ferro-mang. 80%, seaboard	68.00
O.-h. rails, h'y, at mill	40.00
Billets	26.00
Sheet bars	26.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	1.86
Steel bars	1.60
Tank plates	1.60
Beams, etc.	1.60
Skelp, grooved steel	1.60
Steel hoops	1.55
Sheets, black, No. 24	2.00
Sheets, galv., No. 24	2.70
Wire nails	1.85
Plain wire	2.10
Barbed wire, galv.	2.35
Tinplates, 100-lb. box	$4.25

COKE (at ovens).

Welsh foundry	20/– to 22/6
,, furnace	16/– to 17/–
Durham and Northumberland—	
,, foundry	21/– to 25/–
,, furnace	13/3
Midlands, foundry	—
,, furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 per box		16/–
,,	28×20 ,,		32/–
,,	20×10 ,,	22/10½ to	23/6
,,	18¾×14 ,,	16/9 to	17/3
C.W.	20×14 ,,	14/6 to	15/–
,,	28×20 ,,		30/3
,,	20×10 ,,		—
,,	18¾×14 ,,		—

SWEDISH CHARCOAL IRON & STEEL.

	£	s.	d.	£	s.	d.
Pig-iron	£6	0	0 to	£7	0	0
Bars-hammered, basis	£16	10	0 to	£17	0	0
Bars and nail-rods, rolled, basis	£15	17	6 to	£16	5	0
Blooms	£10	0	0 to	£12	0	0
Keg steel	£32	0	0 to	£33	0	0
Faggot steel	£18	0	0 to	£23	0	0
Bars and rods dead soft, st'l	£10	0	0 to	£12	0	0

All per English ton, f.o.b. Gothenburg.
[Subject to an exchange basis of Kr. 18.16 to £1.]

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
May	11 ..	33	16	3	inc.	15/–
,,	12 ..	34	8	9	,,	12/6
,,	15 ..	34	6	3	dec.	2/6
,,	16 ..	33	16	3	,,	10/–
,,	17 ..	35	1	3	inc.	25/–

Electrolytic Copper.

		£	s.	d.		
May	11 ..	37	10	0	inc.	15/–
,,	12 ..	37	15	0	,,	5/–
,,	15 ..	38	15	0	,,	20/–
,,	16 ..	38	10	0	dec.	5/–
,,	17 ..	39	10	0	inc.	20/–

Standard Tin (cash).

		£	s.	d.		
May	11 ..	185	12	6	inc.	62/6
,,	12 ..	187	12	6	,,	40/–
,,	15 ..	183	7	6	dec.	85/–
,,	16 ..	184	0	0	inc.	12/6
,,	17 ..	187	5	0	,,	65/–

Tin (English ingots).

		£	s.	d.		
May	11 ..	187	0	0	inc.	65/–
,,	12 ..	189	0	0	,,	40/–
,,	15 ..	184	15	0	dec.	85/–
,,	16 ..	185	5	0	inc.	10/–
,,	17 ..	188	10	0	,,	65/–

Spelter (ordinary).

		£	s.	d.		
May	11 ..	15	6	3	inc.	3/9
,,	12 ..	15	10	0	,,	3/9
,,	15 ..	15	8	9	dec.	1/3
,,	16 ..	15	8	9	No change	
,,	17 ..	15	13	9	inc.	5/–

Spelter (Electro, 99.9 per cent.).

		£	s.	d.		
May	11 ..	17	15	0	No change	
,,	12 ..	17	15	0	,,	,,
,,	15 ..	17	10	0	dec.	5/–
,,	16 ..	17	10	0	No change	
,,	17 ..	17	15	0	inc.	5/–

Zinc Sheets (English).

		£	s.	d.		
May	11 ..	24	0	0	No change	
,,	12 ..	24	0	0	,,	,,
,,	15 ..	24	0	0	,,	,,
,,	16 ..	24	0	0	,,	,,
,,	17 ..	24	0	0	,,	,,

Lead (English).

		£	s.	d.		
May	11 ..	13	10	0	inc.	5/–
,,	12 ..	13	15	0	,,	5/–
,,	15 ..	13	15	0	No change	
,,	16 ..	13	10	0	dec.	5/–
,,	17 ..	13	10	0	No change	

Imports and Exports of Iron and Steel Castings, etc., in April, 1933, compared with April, 1932 and 1931.

	April, 1931.	April, 1932.	April, 1933.	April, 1931.	April, 1932.	April, 1933.
Imports.	Tons.	Tons.	Tons.	£	£	£
Pipes and Fittings, Cast	987	149	212	14,644	2,619	3,454
Castings, in the Rough, Iron	123	62	6	2,761	911	111
,, ,, ,, Steel	518	46	22	10,647	974	360
Hollow-ware, Cast, not Enamelled	1	1	2	70	84	178
,, ,, Enamelled	nil	22	4	47	641	206
Exports.						
BUILDERS' CASTINGS—						
To Argentine Republic	69	33	8	2,555	1,248	185
,, Irish Free State	240	312	354	12,867	14,405	13,547
,, British South Africa	157	180	136	6,036	6,027	5,797
,, ,, India	87	110	70	3,229	3,756	2,740
,, New Zealand	44	21	10	2,667	887	622
Total (including other countries)	973	962	957	42,861	38,271	37,470
PIPES AND FITTINGS—CAST—						
To Argentine Republic	649	167	201	6,129	1,679	2,156
,, Irish Free State	1,225	943	415	14,557	11,878	5,810
,, British South Africa	712	509	316	8,209	5,544	4,138
,, ,, India	231	116	43	3,809	1,837	672
,, Straits Settlements and Malay States	190	176	12	2,732	2,248	234
Total (including other countries)	6,123	6,853	4,902	69,967	68,010	48,486
HOLLOW-WARE—						
Cast, not Enamelled, and Cast, Tinned	162	201	253	6,281	7,625	7,774
,, Enamelled	35	66	61	3,710	6,589	4,697
CASTINGS, IN THE ROUGH—						
Iron	141	85	105	3,734	3,247	3,763
Steel	144	60	70	4,107	3,076	2,384

WILLIAM JACKS & COMPANY,

WINCHESTER HOUSE, OLD BROAD ST., LONDON, E.C.2.

CLARENCE CHAMBERS, 39, CORPORATION STREET, BIRMINGHAM.

13, RUMFORD STREET, LIVERPOOL.

PIG

IRON

All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

NON-FERROUS METALS

COPPER, TIN, LEAD, SPELTER, ANTIMONY, CHROME ORE.

WILLIAM JACKS & COMPANY,

CENTRAL CHAMBERS, 93, HOPE ST., GLASGOW, C.2.

ZETLAND ROAD, MIDDLESBROUGH.

SMALL ADVERTISEMENTS.

Notice.

Small Advertisements in this section of the Journal are accepted at the prepaid rate of 6d. per line, first line in capitals counting two, average 6 words per line. Minimum charge for one insertion 3/-

(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

ADVERTISER desires position as Foundry Manager or Foreman; practical, technical and commercial training; grey iron, semi-steel, iron alloys, all non-ferrous metals; knowledge of metallurgy; take entire charge.—Box 388, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

REQUIRED, for Glasgow district, Traveller calling upon foundries able to introduce or influence business for well-known Belgian Moulding Sands and Ganister; full support given; commission basis or by arrangement.—Apply in first instance to Box 400, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

REQUIRED, Salesman with first-class connection iron and steel founders Middlesbrough, Newcastle areas; ex-foundry manager preferred. Good agency. High-quality ground ganister, steel moulders' composition, steel and iron moulding sands. New producers, situate County Durham.—Box 402, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

Conducted by the Institute of British Foundrymen by courtesy of the proprietors of The Foundry Trade Journal.

Correspondence should be addressed to the General Secretary, Institute of British Foundrymen, St. John Street Chambers, Deansgate, Manchester, from whom full particulars can be obtained of this service.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

POSITION as Foreman or Assistant Foreman required by Moulder with sound practical experience and good technical training. (212)

METALLURGICAL ASSISTANTS.—Positions required by three Metallurgical Assistants with the following experience respectively: (*a*) Mechanical testing; (*b*) photo-micrographic work; (*c*) metallurgical inspection. The General Secretary of the Institute of British Foundrymen will be glad to supply particulars.

POSITION required as Foreman, Assistant Foreman or Assistant to Foundry Manager by young Moulder with sound practical experience. Secondary school education, good technical qualifications, age 30. Willing to go abroad. (214)

PROGRESSIVE position required by young man who has completed full-time course in foundry practice and has had melting and metallurgical experience with well-known foundry. (215)

PUBLICATION.

RYLAND'S DIRECTORY of the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades. A new edition will be going to press soon. *Write now* for full particulars and advertisement rates.—Industrial Newspapers, Limited, 49, Wellington Street, Strand, London, W.C.2.

PROPERTY.

MAGNIFICENT

11 ACRES WORKS SITE.

SHEFFIELD.

145,000 Sq. Ft. of Shops.

SIDING CONNECTIONS

with L.M. & S. and L. & N.E. Rlys.

WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,

ALBION WORKS, SHEFFIELD.

TO LET, (small) Iron and Brass Foundry, Fitting Shop and nice roomy House; modern conveniences, electric light and power; low rent and low price for plant and stock.—Norman, White House, Whitby, near Ellesmere Port, Cheshire.

BUSINESS FOR SALE.

BRASS Foundry (small) in South for Sale. Chance of a lifetime for young man to start on own; cheap to quick buyer; retiring.—Write, Box 394, Offices of The Foundry Trade Journal, 49, Wellington Street, Strand, London, W.C.2.

MACHINERY.

CUPOLAS.

60-in. Whiting Cupola, as new; cheap.
42-in. Evans Cupola, repaired; cheap.
36-in. Whiting Cupola, repaired; cheap.

A. Hammond, 14, Australia Road, Slough.

FOUNDRY Transverse Bar-Testing Machine by Avery, for 2-in. x 1-in. Bars, 1 to 3 ft. long, calibrated up to 40 cwts., with deflection scale; in good working order. Price £30 or nearest offer.—Hartley, Sons & Company, Engineers, Etruria.

PNEUMATIC MOULDING MACHINES

No. 9 "Ajax" Jolt Turnover.
"Wallwork" Squeezer, 17½-in. x 12½-in. boxes.
"Tabor" Portable Jolt Rollover.
Four No. 1 Britannia Jolters.

HAND MOULDING MACHINES

Eight Standard-size Adaptables with Tail Guides.
Two Large-size Ditto, with Star handle, turnover and adaptable draw frame.
"Coventry" Headpress Squeezer Table, 22 in. x 30 in.
Four 36-in. Farwell Type Universal Squeezers.
Also
Pneulec Sand-drying Plant, 1 ton per hour, Sand Mills, Disintegrators, etc.

S. C. BILSBY, A.M.I.C.E., A.M.I.E.E.

CROSSWELLS ROAD (Adjoining Railway Crossing), LANGLEY, Nr. Birmingham.

'Phone: Broadwell 1359.

THOS. W. WARD, LTD.

LATHES, Capstan, 10½", 9", 8", 7", 6" and 5" centres.
SHAPER, 16/18" str. Centralised control, American pattern, pillar type.
SURFACE GRINDERS, "Ever-ready," cap. 20" and 14" cup wheels.
RECEIVERS, 24' x 4' 6", 300 lbs. w.p.
30,000' 2" dia. S. & S. PIPING.

Write for "Albion" Catalogue.

'Grams: "Forward." 'Phone: 23001 (10 lines).

ALBION WORKS, SHEFFIELD.

MACHINERY—*Continued.*

FOR Sale.—One "Coventry" Patent Pneumatic Jolt Squeeze MOULDING MACHINE, complete with 1½-in. Vibrator. Blow Valve, Resistance Box, Stainless-steel Lifters, and all necessary fittings.

40 Pairs Machined Cast-iron MOULDING BOXES, 18 in. x 13 in. x 4 in. deep, inside measurements; 25 Pairs Ditto 18 x 13 x 8; 22 Cast-iron PATTERN PLATES; complete with loose Pins and all boxes jig-drilled. All in first-class condition.

For further particulars apply, Audley Engineering Company, Limited, Newport (Shropshire).

MISCELLANEOUS.

MOULDERS' SPRIGS AND WIRE PINS, all lengths—all British. Latest reduced prices, carriage-paid service. — William Olsen, Limited, Cogan Street, Hull.

TO ANY FOUNDRY.—A Pair of Neild Safety First Boots (Prov. Patent No. 8580) will be sent on APPRO. Specially designed to protect from Molten Metal, Sand, etc., and are approved by H.M. Factory Inspectors.—Neild, Hough End, Bramley, Leeds.

'Phone: 287 SLOUGH

HAND MOULDING MACHINES

Six Standard "Adaptables"	£12 each
Two "LARGE" Adaptables (take 30"×30")	£15 each
24"×30" Darling & Sellars turnover	£15
Two 18"×16" Coventry HEADRAM squeezers	£18 each

PNEUMATIC MACHINES

14"×16" Tabor split pattern ...	£30
30"×20" Macdonald jolt rollover...	£60
20"×16" Macdonald jolt rollover...	£40
No. 20 Macdonald plain jolter with 90"×90" table, jolts 8 tons	£160

AIR COMPRESSORS
ALL SIZES IN STOCK.

Every Machine overhauled and retested.

BUY FROM ME AND SAVE MONEY!

Alex. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

To Engineers, Founders, Manufacturers. Fine site of nearly 3 acres on Arterial Road with Foundry and Workshops and own Rail Sidings into premises. Modern Offices, Warehouse and Workrooms. Central Heating.

CHARLES A. TRICKS & SON,
Auctioneers,
ST. NICHOLAS STREET, BRISTOL.

RYLAND'S DIRECTORY

[2,200 pages 8½" × 5½"].

The standard work of reference covering the Coal, Iron, Steel, Tinplate, Metal, Engineering, Hardware and Allied Trades.

A new edition will be sent to press soon. Write us now for full particulars and Advertisement rates.

INDUSTRIAL NEWSPAPERS, Ltd.
49, Wellington St., Strand, London, W.C.2.

Telephone: Temple Bar 3951 (5 lines).